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AMERICAN JOURNAL OF OPHTHALMOLOGY

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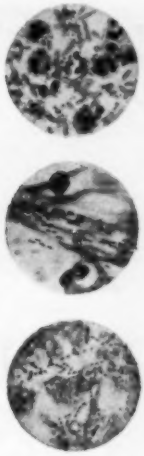

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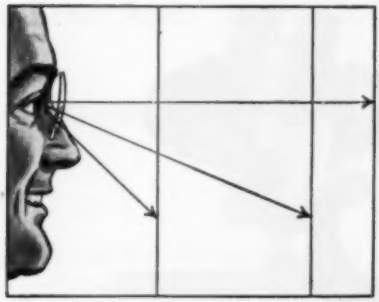

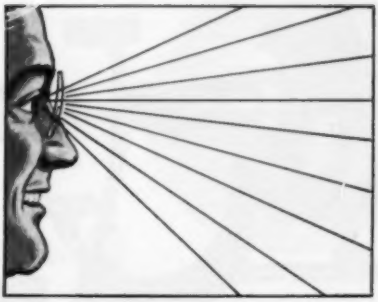

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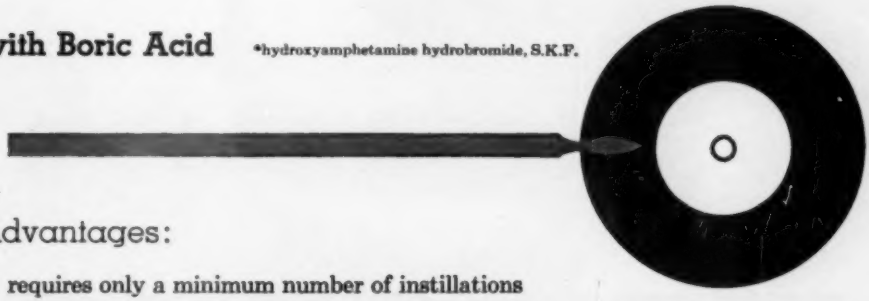

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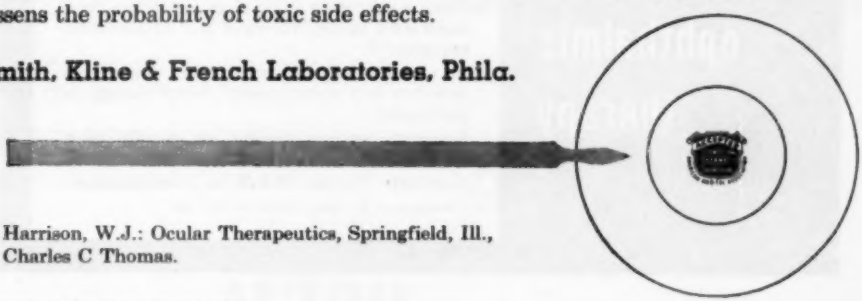

1. Harrison, W.J.: Ocular Therapeutics, Springfield, Ill., Charles C Thomas.

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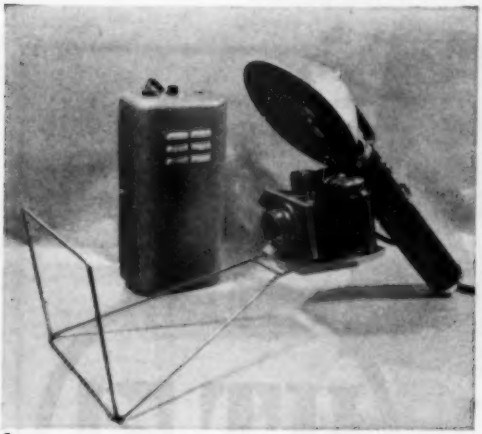

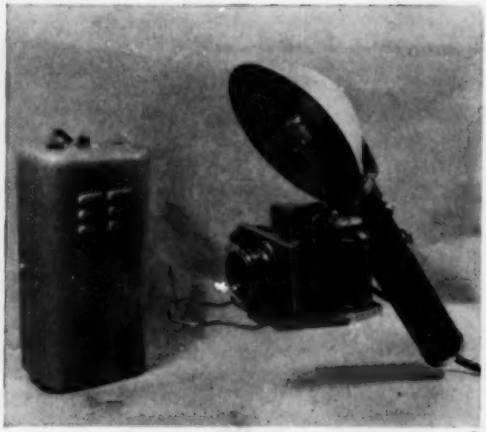

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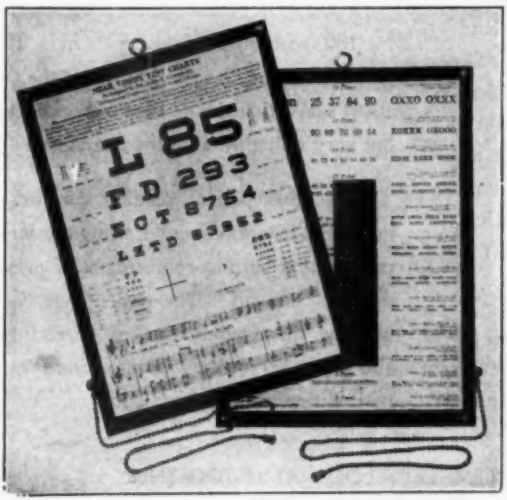

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We feel that regardless of the amount of "slab off" necessary to balance the reading centers, they should be balanced. The patients are much better satisfied and report more satisfactory reading vision. We have the case of Mrs. G. who was unhappy with her bifocals, which had not been balanced. The prescription was: R.E. +0.50+1.50×95, L.E. −5.00−3.50 × 165 with +2.50 added O.U.

The ophthalmologist who referred the patient to us suggested that a balanced center bifocal be used. The imbalance amounted to 6.5 prism diopters which amount of base down prism was "slabbed off" from the left bifocal. The patient was satisfied for the first time since she had been wearing bifocals.

It is just as important to balance binocular cataract cases. Following surgery, Mr. P. required the following prescription: R.E. +12.00+1.00 × 140, L.E. +8.00+9.00 × 180 with add of +2.50 O.U. The glasses were made accordingly and the patient was satisfied with his distance vision but very unhappy with the near vision.

To give this patient reading comfort a new right lens was ground, using the same prescription but incorporating a 3.5 prism diopter "slab off." The patient has been wearing this combination of corrections and balanced centers for several years with entire satisfaction.

"IF IT'S A LENS PROBLEM, LET'S LOOK AT IT TOGETHER"

AMERICAN JOURNAL OF OPHTHALMOLOGY

SERIES 3 · VOLUME 34 · NUMBER 1 JANUARY, 1951

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ABSTRACTS

Diagnosis and therapy; Ocular motility; Conjunctiva, cornea, sclera; Uvea, sympathetic disease, aqueous; Glaucoma and ocular tension; Crystalline lens; Retina and vitreous; Optic nerve and chiasm; Neuro-ophthalmology; Eyeball, orbit, sinuses; Eyelids, lacrimal apparatus; Tumors; Injuries; Systemic disease and parasites; Congenital deformities, heredity; Hygiene, sociology, education, and history 128

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 34 JANUARY, 1951 NUMBER 1

RETROLENTAL FIBROPLASIA*

THE FIFTH FRANCIS I. PROCTOR LECTURE

ALGERNON B. REESE, M.D., AND FREDERICK C. BLODI, M.D.
New York

An invitation to deliver the Proctor Lecture is one of the highest honors that can come to an ophthalmologist, by virtue of the distinction of the audience before whom the lecture is delivered and the prestige with which the previous lecturers have endowed it.

The occasion honors the memory of Dr. Francis I. Proctor. Through the generosity and vision of his widow, Elizabeth C. Proctor, Dr. Proctor has become one of the great benefactors of ophthalmology. The foundation which bears his name bids fair to rank with the very first of our American laboratories for basic and clinical research in ophthalmology. It is setting a standard on the Pacific Coast for the highest quality of effort and achievement, and this in turn is bound to be a source of inspiration to high endeavor wherever research in our specialty is being carried on.

It would seem appropriate at this time to refer to the fact that work conducted in the Proctor Laboratory formed the basis for a thesis recently submitted to the American Ophthalmological Society which was of such high merit that the society voted to publish it as a separate monograph. This is the first time in the society's history that such a disposition has been made of a candidate's thesis.

In 1943 Terry[1] first observed an increase in the incidence of infant blindness due to what he termed "retrolental fibroplasia." At that time there was general confusion as to the exact nature of the condition. Terry thought it was related to the remains of the hyaloid system, including the tunica vasculosa lentis; Reese and Payne[2] included under this term three conditions which have since been differentiated as retrolental fibroplasia, persistent hyperplastic vitreous,[4] and retinal dysplasia;[5] Krause,[3] who thought the condition should be called "encephalo-ophthalmic dysplasia," was evidently referring not only to retrolental fibroplasia but to retinal dysplasia as well.

CONDITIONS WITH WHICH RETROLENTAL FIBROPLASIA HAS BEEN CONFUSED

An attempt has been made to define retrolental fibroplasia and to differentiate it clearly from other conditions with which it has been confused. The two most important of these are:

1. *Persistent hyperplastic vitreous*[4] (tunica vasculosa lentis) is not related in any way to retrolental fibroplasia but is the condition most frequently confused with it. This is largely due to the fact that there is a great deal of pathologic material available on persistent hyperplastic vitreous and very little on retrolental fibroplasia except in its late or end stages. Although the incidence of persistent hyperplastic vitreous is low, material for study is relatively abundant because the affected eyes, often thought mistakenly to

* Presented at the University of California Medical School, September, 1950. This work was supported by a grant from the Dunlevy Milbank Foundation, Inc.

harbor retinoblastoma, are quite frequently enucleated.

Persistent hyperplastic vitreous is unilateral and the involved eye is often slightly smaller than the fellow eye. The opaque tissue behind the lens is densest in the central portion and fades in the periphery where long ciliary processes can invariably be seen.

Due to a break in the posterior capsule of the lens opposite the site of the opaque tissue, a posterior cortical cataract develops and gradually produces a complete opacity of the lens; when this has happened, the true nature of the condition is obscured. When the lens swells, secondary glaucoma may ensue. If the opaque tissue back of the lens is sufficiently thin around the periphery to permit a view of the interior of the eye, a persistent hyaloid artery can usually be seen.

2. *Retinal dysplasia*[5] is a second important condition which is confused, though less frequently, with retrolental fibroplasia. It is always bilateral and the eyes usually show some degree of microphthalmos. Histologically the retina shows signs of dysplasia and usually of an accompanying rosette formation. The fibrous tissue behind the lens seems to be persistent primary vitreous. The secondary vitreous is usually deficient or not formed at all.

The affected infants show, in addition to the ocular changes, malformations elsewhere over the body. These are generally anomalies of the brain, with mental retardation common, and of the heart, vascular system, or skeleton, one or another of which often causes early death. The condition occurs in the newborn but is not related to prematurity. Its incidence is low.

Acute and cicatricial stages of retrolental fibroplasia

Retrolental fibroplasia is a clear-cut entity affecting primarily premature infants of low birth weights. About two percent of cases occur in full-term infants. The disease has an acute or active phase which subsides at about three months of age, and a late or cicatricial stage which follows thereafter. Characteristically the condition is bilateral and we question whether the lesion can occur in one eye to the complete exclusion of the other.

Acute phase (fig. 1—A, B, C, D, E; fig. 22). The active phase of the disease is usually first appreciated clinically between the third and fifth weeks of life and is characterized by a dilatation of the retinal vessels, hemorrhage, neovascularization over the surface of the retina and in the vitreous, and transudation. This stage was first described by Owens and Owens.[6]

When the disease reaches the stage at which dilatation of the retinal vessels and hemorrhage occur, a high percentage of cases show spontaneous regression;[6, 7] when it reaches the stage of neovascularization and transudation, spontaneous regression is rare. The dilatation of the vessels and the hemorrhages are seen over the entire fundus, whereas the transudation and neovascularization are first noted in the extreme periphery of the fundus.

The neovascularization, which occurs over the surface of the retina and reaches into the vitreous, is almost certainly present before it can be recognized clinically. The small, newly formed, vascular channels have translucent or transparent walls so that only the blood circulating within them is visible. They are thus impossible to distinguish against the bright red background of the choroid, and it is only when the retina becomes opaque from transudation or detachment that they can be seen (fig. 2).

Recently we have given particular attention to the detection of this neovascularization and we have been able to see it in areas where there is no edema or detachment of the retina. In some cases tufts of newly formed vessels over the retina are quite conspicuous. Also, vascular dilatation and neovascularization occur in the iris concurrent with that in the retina. In the acute phase the process is usually reversible, at least to a degree which permits the retention of a good, functioning eye.

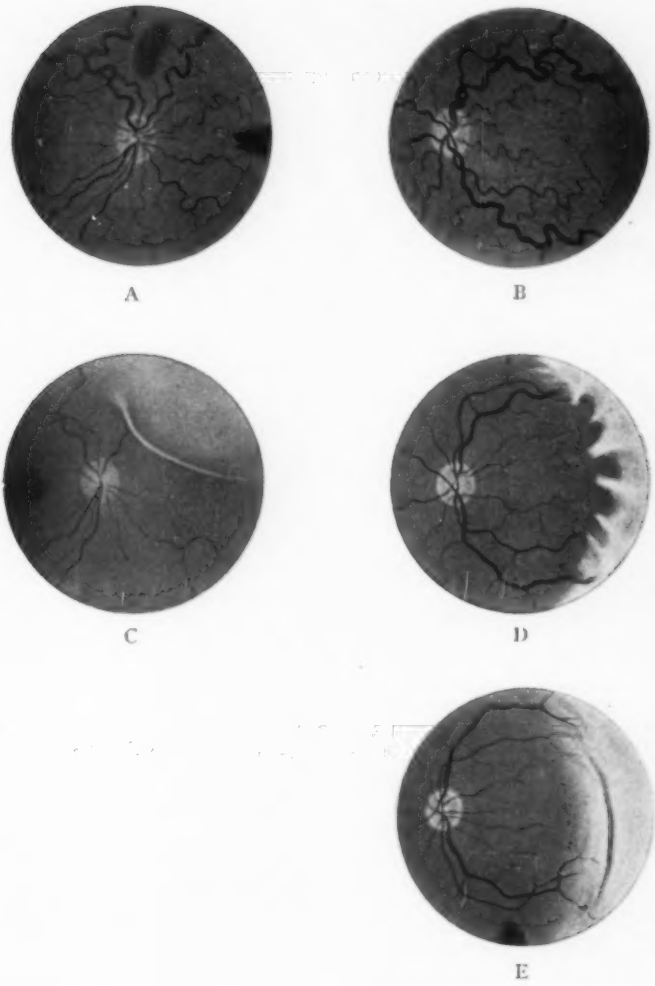


Fig. 1 (Reese and Blodi). A series of five drawings of both fundi of a premature infant (birth weight, 1,474 gm.) to show the course of development of retrolental fibroplasia from its incipient stage to that approaching the irreversible stage.

(A) The right fundus at the age of five weeks. The retinal vessels show a marked dilatation and tortuosity, and there are two large hemorrhages present.

(B) The left fundus at the age of five weeks, showing the tremendous dilatation and tortuosity of the retinal vessels.

(C) The right fundus at the age of nine weeks, showing the beginning edema and detachment of the retina in the periphery. A partially absorbed hemorrhage is visible. The white line represents a fold in the retina.

(D) The left fundus at the age of nine weeks, showing the edema, the beginning of fibrous-tissue formation, and detachment of the retina in the periphery.

(E) The left fundus at the age of 11 weeks, showing a progression of the process to the formation of a peripheral detachment of the retina with a fold.

There is a marked paucity of pathologic material on retrolental fibroplasia in the active phase. Most of the material available is obtained in the late or cicatricial stage when the basic lesion has been masked by secondary changes. We are fortunate, therefore, in having both eyes and the complete autopsy findings from one case of early

Fig. 2 (Reese and Blodi). The fundus drawing of a six-week-old premature infant (birth weight, 1,187 gm.) with early retrolental fibroplasia. The drawing shows the periphery of the fundus temporally where the retina is somewhat opaque due to edema and probably early flat detachment. The partially opaque retina permits a view of the newly formed vascular channels over the surface of the retina.

retrolental fibroplasia. This case has been referred to in previous publications[2, 4] but since then the pathologic material has been further sectioned and studied.

The patient, one of twins and weighing 1,400 gm. at birth, died at 11 weeks of age. At seven weeks of age some exophthalmos of the right eye was noted. At eight weeks (three weeks prior to death) both eyes were examined under general anesthesia and early retrolental fibroplasia was identified. The other twin lived and is completely blind from typical retrolental fibroplasia in both eyes. It

Fig. 3—(A). A section of the retina of the right eye showing the vascular budding from the internal surface.

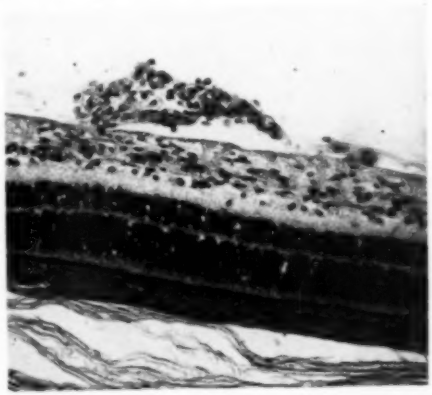


Fig. 3—(B). The section of the retina of the right eye showing a further stage of the vascular budding from the inner surface of the retina.

can be stated with certainty, therefore, that the eyes obtained for examination represent

Fig. 3—A to J (Reese and Blodi). A premature infant (birth weight, 1,400 gm.) with retrolental fibroplasia diagnosed after an examination of both fundi under general anesthesia. While the disease was still in its acute phase the patient died. Both eyes as well as a complete autopsy were obtained. The twin of this patient lived and has complete bilateral retrolental fibroplasia.

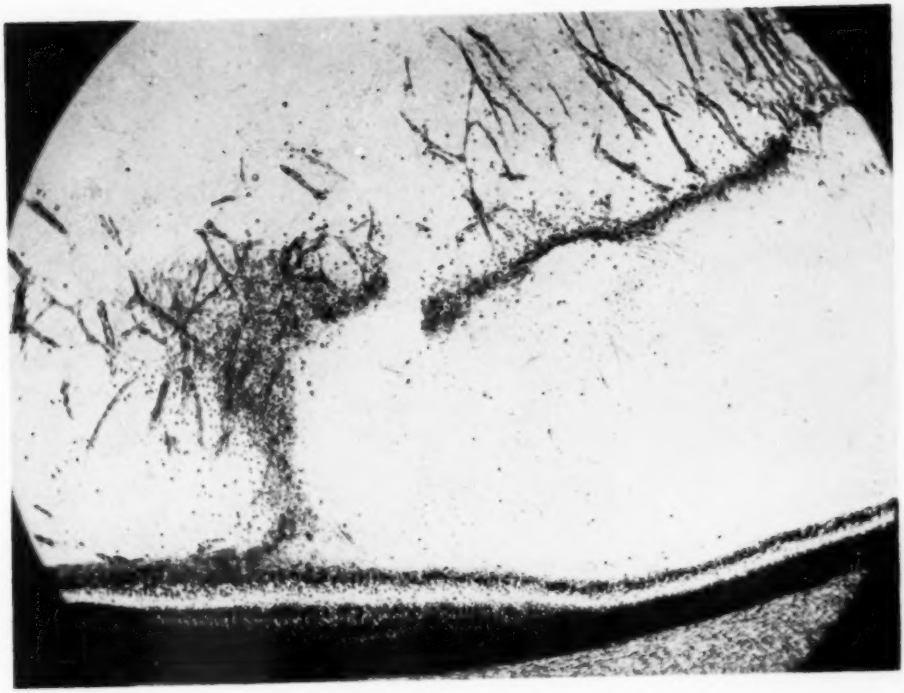


Fig. 3—(C) (*above*). A section through the right eye showing the newly formed vascular channels extending throughout the vitreous.

retrolental fibroplasia in its early stage.

The sections of these eyes show angiomatous tissue extending from the retina into the vitreous (fig. 3—A, B, C, D, E, F), particularly in the periphery around the base of the vitreous.

Although there is also some transudate, some hemorrhage, and early organization, the outstanding and characteristic feature is this angioplastic process in the vitreous. From this it may be deduced that the condi-

Fig. 3—(D). A section from the retina of the left eye showing the newly formed vessel extending from the retina into the vitreous where at present it is still confined to the area between the internal surface of the retina and the hyaloid membrane.

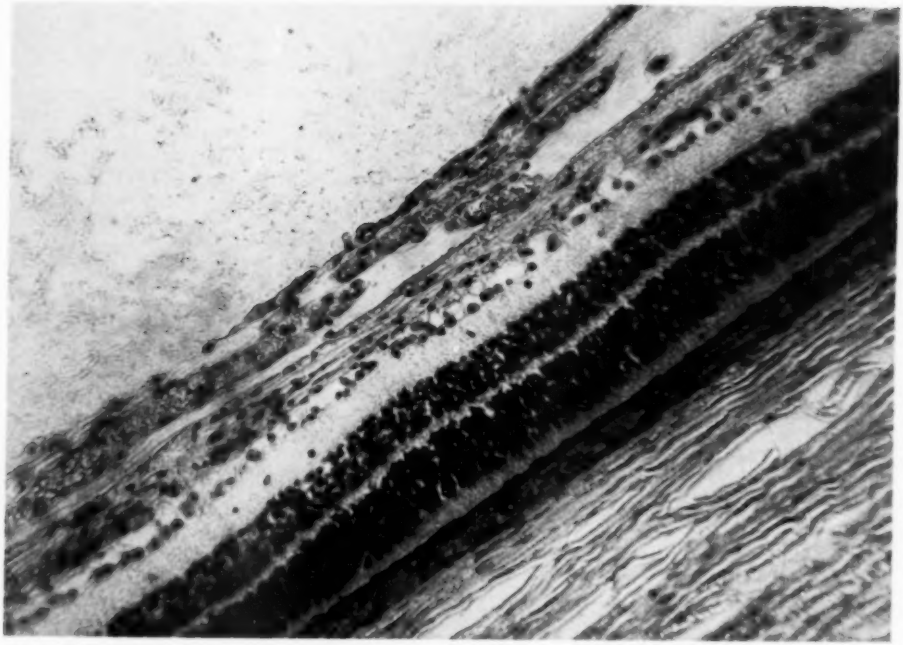
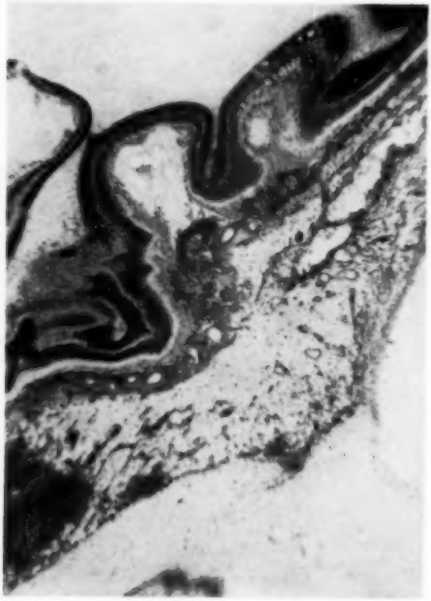


Fig. 3—(E). A section through the retina of the left eye showing the newly formed vascular channels coursing along the internal surface of the retina.



tion is primarily a disease of the vitreous in which the noxious agent apparently causes vessels to emerge from the retina and to enter the vitreous. In this acute phase the retina does not participate in the process except as the source of the newly formed vessels.

In view of the amount of neovascularization that occurs in the vitreous and the extent of the pathologic process, it was surprising how few sites could be found at which the blood vessels could be seen coming from the retina to the vitreous.

The autopsy performed on this patient showed a hemangioma of the right orbit

Fig. 3—(F). A section through the left eye far in the periphery showing the beginning fibrous-tissue formation due to organization of hemorrhage and transudate. In this newly formed edematous tissue are many newly formed blood vessels. Due to beginning contracture the retina is thrown into folds.

(fig. 3—G) which was the cause of the exophthalmos noted at the seventh week of life. Hemangiomas were also noted in the cervical region (fig. 3—I), in the choroidal plexus of the fourth ventricle (fig. 3—H), and in the carotid body (fig. 3—J).

Pathologic processes identical in every de-

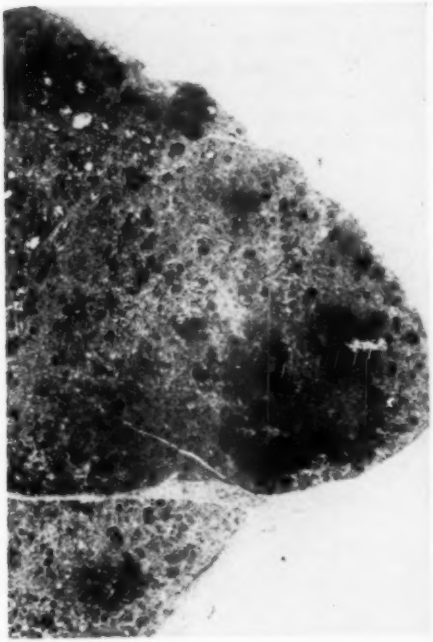


Fig. 3—(G). A section through the hemangioma of the orbit which caused the exophthalmos.

tail to that seen in the case just described have been noted in another infant (fig. 4—A, B, C, D) whose birth weight was 1,950 gm. and who died shortly after birth. This infant, who was believed to be full-term, showed, at autopsy, anencephaly, cranioschisis, and a hypoplasia of the adrenal glands. This last may be a significant finding in view of the possibility, to be discussed later in the section on treatment, that retrolental fibroplasia

Fig. 3—(H). A section through the hemangioma of the choroidal plexus of the fourth ventricle.

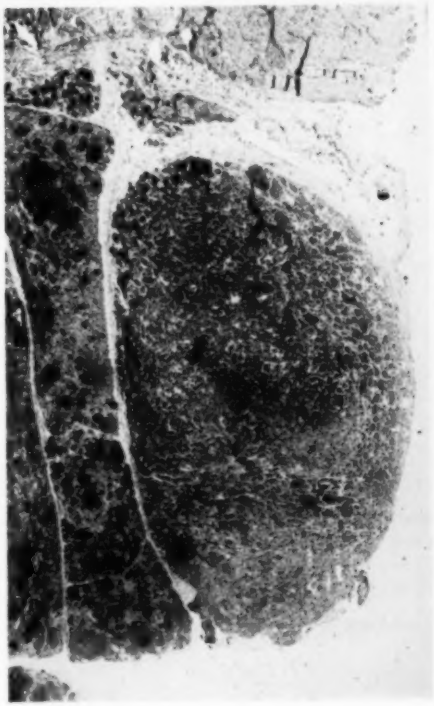
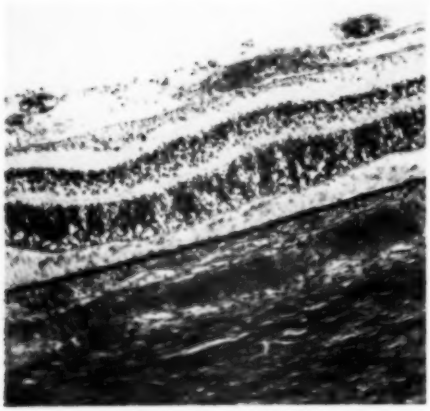


Fig. 3—(I). A section through the hemangioma in the cervical region near the pharynx.

Fig. 3—(J). A section through the hemangioma of the carotid body.



may be related to a deficiency of the adrenal cortical steroids.

Cicatricial phase. The acute phase of the disease, consisting of dilatation of retinal vessels, hemorrhage, neovascularization, and transudation, subsides between the third and fourth months of life and is followed by a stage of organization and contracture. This cicatricial stage of the disease constitutes retrolental fibroplasia as commonly known since it is usually in this stage that it is first seen. The severity of this final, or cicatricial, stage of the disease is determined by the extent to which it progressed and regressed

Fig. 4—(B). A section through the retina of the right eye showing the vascular budding into the vitreous from the retina in which the blood vessels are dilated.

←

Fig. 4—(A). A section of the retina of the right eye showing the newly formed vascular channels extending along the inner surface of the retina.

Fig. 4—A to D (Reese and Blodi). Sections from both eyes of an infant weighing at birth 1,950 gm. The infant died one week after birth.

in the acute phase. A variety of clinical manifestations are therefore to be seen, the more important of which may be described as follows:

1. In the usual form of the disease, the entire pupillary area is obstructed by opaque tissue back of the lens (fig. 5). No fundus reflex is visible. In the extreme periphery of this opaque tissue, dentate processes can invariably be seen and are pathognomonic of the disease (fig. 6). Sometimes these teeth-like projections attach themselves to uveal tissue, and presumably to ciliary processes, so that the dentate process is prolonged as a thread of uveal tissue.

The anterior chamber is characteristically shallow, but in this absolute form of the disease it may become so increasingly shallow that the iris and lens finally touch the cornea and produce secondary corneal opacities (figs. 7 and 8), even to the point of obliterating completely the anterior chamber and of producing a wholly opaque cornea.

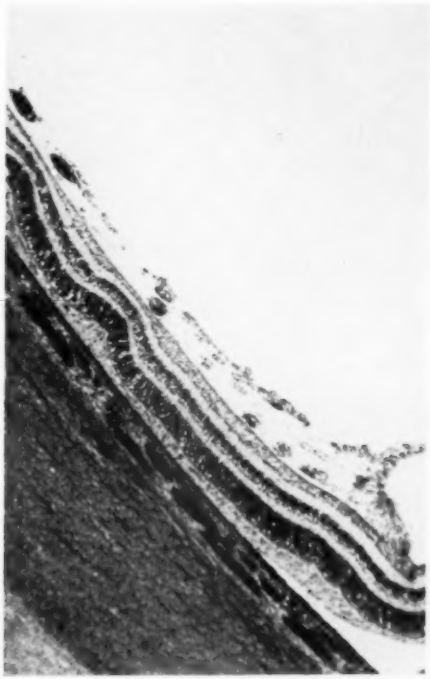


Fig. 4—(C). A section of the retina of the left eye showing the newly formed vascular channels and some fibrous tissue coursing in the vitreous along the inner surface of the retina. There is dilatation of the choroidal vessels.

Fig. 4—(D). A section through the retina of the left eye far in the periphery showing the newly formed vascular spaces in the vitreous together with some fibrous tissue and some hemorrhage.

In the very late stages the anterior chamber again deepens and the adhesions of the iris to the cornea may retract; this development produces bridges of iris tissue reaching from the posterior surface of the cornea to the surface of the iris.

2. In less severe cases the disease manifests itself as a retinal fold which extends from the disc to the opaque tissue far in the periphery of the fundus (fig. 9). That portion of the retina which still remains attached has a pale appearance, attenuated blood vessels, sometimes diffuse pigment changes, and occasionally some opaque tissue over its surface.

3. In still milder cases the disease may

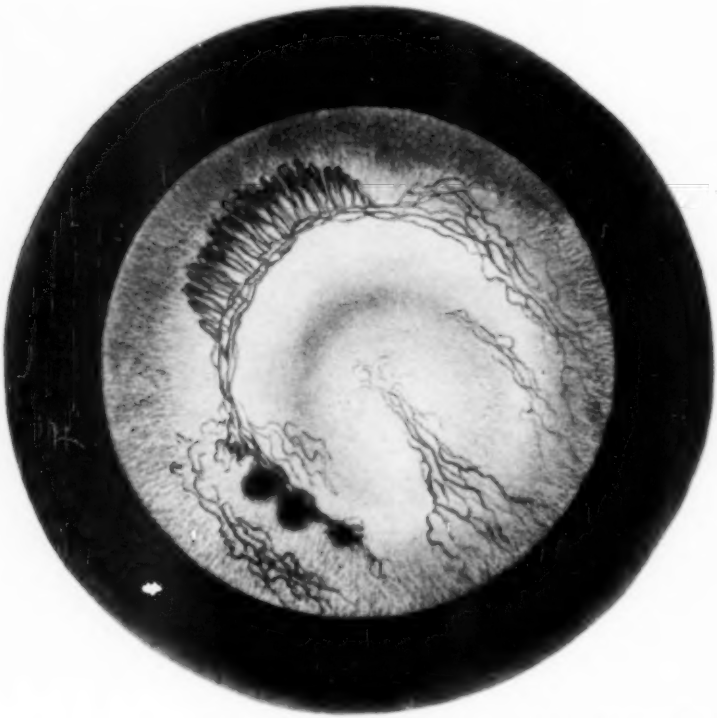


Fig. 5 (Reese and Blodi). The right eye of a six-month-old premature infant (birth weight, 1,303 gm.) with retrolental fibroplasia. The entire pupillary area is covered by opaque tissue over the surface of which there are some newly formed blood vessels as well as some hemorrhage. The arrangement of the blood vessels suggests angiomatous tissue.

Fig. 6 (Reese and Blodi). The right eye of a nine-month-old premature infant (birth weight, less than 1,360 gm.) with retrolental fibroplasia. The drawing, which is the periphery of the opaque tissue back of the lens, shows the dentate processes, a constant finding in the disease.

show itself as opaque tissue in the extreme periphery of the fundus, and this tissue may be visible only after a careful search or after indentation of the sclera. Such peripheral involvement may affect primarily a quadrant or only half the fundus, but in some instances it extends completely around the periphery and, when marked, appears as a ring of opaque tissue down through the center of which the posterior pole of the fundus can be seen.

In these cases in which the retina is partially attached, the fundus exhibits the pale-

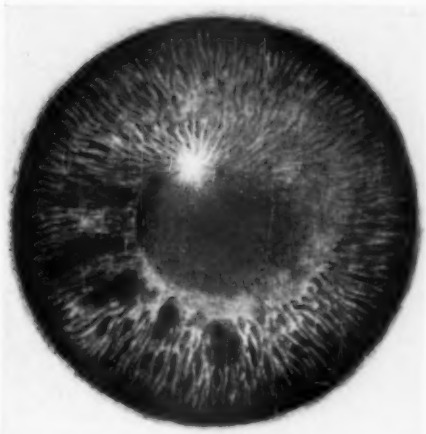


Fig. 7 (Reese and Blodi). The cornea of a premature infant with retrolental fibroplasia. The iris and lens have advanced forward and touch the cornea at the site just below the center where an opacity of the cornea is just beginning.

ness, the attenuated blood vessels, and sometimes the slight pigmentary changes characteristic of the disease (fig. 10). In the later stages of the disease the fundus is never normal in appearance, even when the retina is attached.

4. Malformation of the disc and opaque tissue around it are sometimes noted. When there is an area of opaque tissue in the periphery in one sector of the fundus, the pigment conus of the disc is always on the side opposite this peripheral tissue (fig. 9),

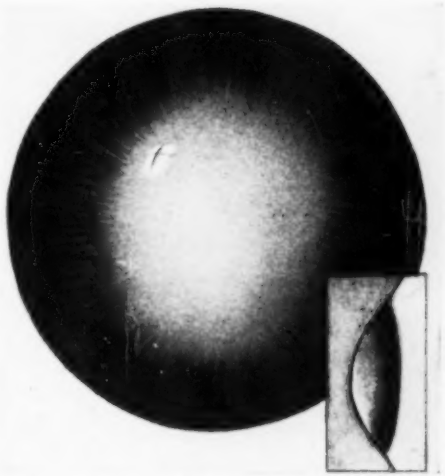


Fig. 8 (Reese and Blodi). The cornea of a three-year-old premature child with retrolental fibroplasia. The central portion of the cornea is entirely opaque due to an advancement of the iris and lens forward where, in the central area, they are in apposition to the posterior surface of the cornea. The insert shows the obliteration of the anterior chamber over the area of the corneal opacity.

and the disc faces the opaque tissue in a colobomalike arrangement. Pupillary membranes are not uncommon and it is sometimes difficult to say whether or not they are attached to the collarette of the iris or merely confined to the pupillary area. In most cases they seem to be attached to the collarette.

5. In the cicatricial stage of the disease a rather common occurrence is enophthalmos with a sinking of the septum orbitale. This sinking process produces a depression of the skin around the orbital margin and a dark shadow is cast; the eye then appears to be sunken (fig. 11).

We believe this appearance is due to an orbital contracture comparable to that which takes place in the eye. During the active stage of the disease the affected infants show a certain fullness of the orbit, and sometimes the eye even appears to protrude slightly. This is evidence of an orbital involvement by the angioplastic process and

Fig. 9 (Reese and Blodi). The left fundus of a seven-month-old premature infant (birth weight, 1,331 gm.) with retrolental fibroplasia. The drawing shows a retinal fold extending from the disc to the periphery temporally where, in the extreme periphery, is an area of opaque, white tissue.

the ensuing sunken appearance reflects the later stage of contracture.

Relationship of hemangiomas to retrolental fibroplasia

Skin hemangiomas are said to occur in from one to two percent of all full-term infants[8] and in from three to 10 percent of premature infants.[8, 9] In our experience they have occurred in approximately 15 percent of premature infants with retrolental fibroplasia. Some observers have failed to find this higher incidence in the premature infants with retrolental fibroplasia,[10] but deductions from figures on skin hemangiomas in infants must be considered inconclusive in view of the fact that the age and birth weight of the patients at the time of observation are usually not given.

It is noteworthy that only 17 to 20 percent of the skin hemangiomas occurring in newborn infants are noted at birth.[11] When

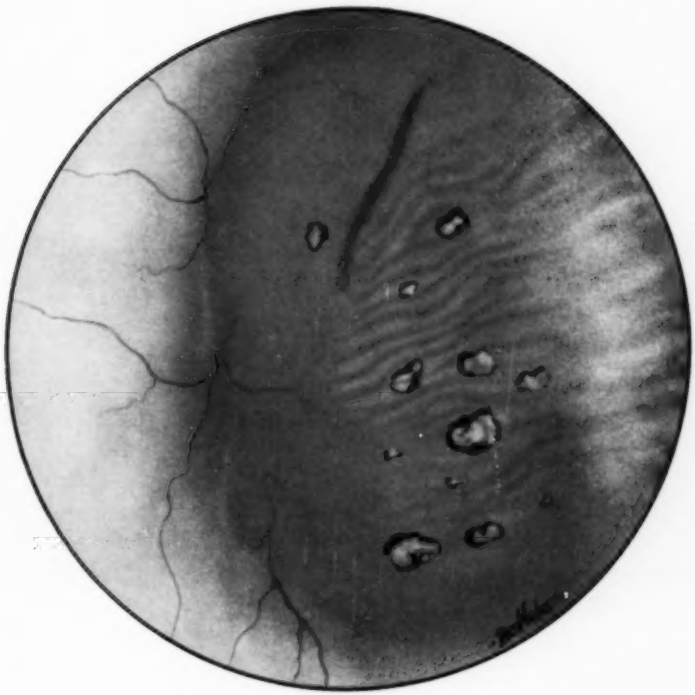


Fig. 10 (Reese and Blodi). The right fundus of a 10-month-old premature infant (birth weight, 1,724 gm.) with retrolental fibroplasia. In the periphery to one side is the detached retina with some contracting fibrous tissue over its surface. The part of the retina which is still attached shows areas of pigmentary disturbance resembling those usually seen following choroiditis. Also, this portion of the fundus is somewhat pale and the blood vessels are markedly attenuated.

present they are sure to be detected since virtually all infants are closely scrutinized at birth by physicians and parents and even pinpoint lesions noted.

The fact is that the remaining 80 to 83 percent of skin hemangiomas make their appearance between the first and sixth weeks of postnatal life. The time at which the

Fig. 11 (Reese and Blodi). An 11-year-old boy with retrolental fibroplasia. The right eye has been enucleated presumably because retinoblastoma was suspected. An implant was placed in this orbit and the patient is now wearing a prosthesis. The left eye shows some enophthalmos and sinking of the septum orbitale which is particularly noticeable through the upper lid. Although this eye turns in and up the patient is fixing with this eye which has about 3/200 vision. The eye is turned in and up in order to utilize a small area of the retina still attached.

Fig. 12 (Reese and Blodi). A skin hemangioma behind the ear of a patient (child born prematurely, birth weight 1,130 gm.) with retrolental fibroplasia. It is quite elevated and is in the process of regression as evidenced by the bleaching and wrinkling of the skin in the central portion.

observations are made is therefore of first importance in determining the incidence of hemangiomas in infants.

There is general agreement, however, that skin hemangiomas have a much higher incidence in premature than in full-term infants, and that the lower the birth weight the higher the incidence.[9] All skin hemangiomas in newborn infants grow for the first six months of life, sometimes at an alarming rate. During the next six months (fig. 12) they regress and have usually disappeared completely by the end of the first year.

Fig. 13 (Reese and Blodi). A premature infant (birth weight, 1,130 gm.) with bilateral retrolental fibroplasia has a hemangioma of the right orbit and the right upper lid. (Patient of Dr. Ralph Danielson.)

The pathologic development of retrolental fibroplasia is that of an angiomatous process which manifests itself predominantly in the vitreous, and the many newly formed vascular channels are identical histologically with those associated with hemangioma. In the case already described, which showed the early changes of retrolental fibroplasia and came to autopsy, angiomas were noted in various regions of the head, including the orbit, and we have data on another case in which there was an associated angioma of the orbit and lids (fig. 13).

As already noted, skin hemangiomas of premature infants run a course analogous to that of retrolental fibroplasia; that is, both undergo an active phase in which progressive changes take place, a subsequent regressive period, and finally a stage of cicatrization, with the time factors concerned in the various phases of the two conditions roughly comparable.

Both conditions may or may not be present at birth but are perhaps often present, though undetected, in a subclinical form. Moreover, as has already been pointed out, it is impossible to detect the newly formed vascular channels in their early stage because only the blood circulating in the small lumina is visible and the channels are lost to view against the red background of the choroid.

When, however, the retina becomes opaque due to detachment or transudate, the neovascularization becomes visible, particularly in the periphery of the fundus (fig. 2). In the case which came to autopsy and furnished us with a picture of the early changes in retrolental fibroplasia, the newly formed vessels could not be seen when the fundus was examined under general anesthesia three weeks prior to death.

Fig. 14 (Reese and Blodi). A section through the optic nerve of an eye with retrolental fibroplasia. Large, clear vascular channels are seen throughout the optic nerve. These are larger and in excess of the normal channels seen in the nerve.

Systemic nature of retrolental fibroplasia

Evidence in favor of the conclusion that retrolental fibroplasia represents the eye manifestation of a generalized congenital angioplastic process, occurring chiefly in the region of the head in some premature infants with low birth weights, may be summarized as follows:

1. The autopsy of the case of early retrolental fibroplasia, in which the diagnosis was verified clinically and confirmed further by the fact that the surviving twin has typical bilateral retrolental fibroplasia, showed widespread angiomatous areas over the region of the head.

2. Skin hemangiomas, which are more prevalent in premature than in full-term infants and appear to be especially prevalent in infants with retrolental fibroplasia, show a progressive and regressive course similar to the process observed in the eye condition.

3. Newly formed vascular channels have been observed in the optic nerves (fig. 14) of eyes affected with retrolental fibroplasia, as well as in the iris (fig. 15) and in the orbit (fig. 16) where they probably cause some exophthalmos and fullness of the lids during the acute phase, and enophthalmos after the regressive or cicatricial phase.

Microscopic examination of eyes of premature infants

Ninety-three sets of eyes from premature infants who were either dead at birth or

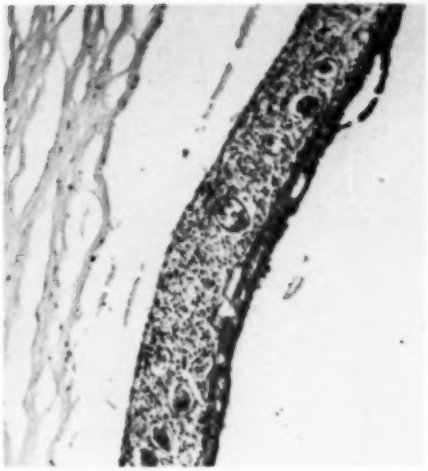


Fig. 15 (Reese and Blodi). A section of the iris of an eye with retrolental fibroplasia. Throughout the iris are many large vascular channels in excess of those normally seen.

died a short time after birth have been available for serial sectioning and microscopic examination. Fourteen of these sets were too macerated to use and reduced our series to 79 sets of eyes. Of these, 21 sets were eyes of still-born infants and should perhaps not be considered representative of the type of premature infant under discussion.

Fig. 16 (Reese and Blodi). A section of the orbital tissue in a case of retrolental fibroplasia. There are an excessive number of large vascular channels throughout the tissue.

The principal findings were:

1. Neovascularization was noted in the vitreous in both eyes of a single case, an infant weighing 1,950 gm. at birth (fig. 4), which has already been referred to; in one other set of eyes some newly formed vascular channels were noted along the surface of the retina.

From this it may be deduced that the presence of neovascularization over the surface of the retina or in the vitreous at birth is exceptional rather than usual, but it should be borne in mind that this change may be present in a subclinical form or before clinical recognition is possible; as already noted, the small, newly formed capillary spaces are lost to view against the red background of the choroid, and these early changes are in the extreme periphery of the fundus where they are difficult to detect.

2. An inflammatory process of the uvea was noted in 18 percent of the eyes examined. The mothers of all but one of these infants reacted negatively to tests for syphilis, the result in one test being unknown.

In some instances the inflammatory process seemed to involve only the choroid (fig. 17), while in others it extended throughout the uvea, and inflammatory cells were even noted in the vitreous (figs. 18 and 19). In one case the process was noted particularly around the hyaloid system (fig. 19).

The incidence of this uveal inflammation in premature infants was approximately the same as the incidence of retrolental fibroplasia and of skin hemangiomas. It is possible that the uveitis precedes the neovascularization and that the same noxious agent provokes both.

Other features of retrolental fibroplasia

consistent with the presence of an inflammatory process are: (1) The diffuse, dustlike opacities of the vitreous which occur not infrequently in the early stages and which could well be the result of inflammation of the uvea;[12] (2) the areas of pigmentary change, similar to those usually interpreted as sequelae of chorioretinitis, which are not infrequently seen in those cases of retrolental fibroplasia in which the retina is partially or totally attached and therefore visible ophthalmoscopically (fig. 10); as a matter of fact, it is usual for some pigmentary disturbance to occur in the fundus as a sequela of the active process of retrolental fibroplasia; (3) the changes noted around the iris (posterior synechias, atrophy, and so forth); and (4) the variations in incidence displayed by the disease and the fact that it never affects a sibling; both these latter characteristics might indicate an immunologic process.

3. A large retinal hemorrhage in the region of the ora serrata was noted in 14 percent of the eyes (fig. 20). Small retinal hemorrhages elsewhere over the fundus were extremely common but the hemorrhage referred to here was extensive and was in the extreme periphery of the retina. We cannot say whether or not this finding is significant.

4. Massive congestion of the blood vessels of the retina and uvea were noted in 14 percent of the eyes. Dilatation of these vessels can occur as a postmortem change, particularly when there is slight maceration, so that this finding is difficult to evaluate. It may be said, however, that tremendous dilatation of the vessels was noted not infrequently in eyes which showed no other appreciable postmortem changes.

Treatment

Cicatricial stage

Retrolental fibroplasia is usually first recognized in the late, cicatricial stage when the retina is completely detached and drawn up into contracting fibrous tissue back of the lens. When the disease has reached this stage, obviously no treatment is of any avail. In certain cases in which it has been detected before this final stage, however, attempts have been made to improve the situation by surgical means.

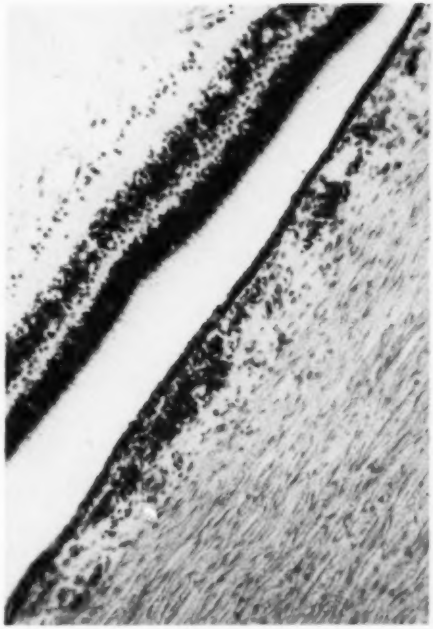


Fig. 17 (Reese and Blodi). A section of the eye of a premature infant who died 30 minutes following birth. An inflammatory reaction is seen in the choroid.

Surgical intervention. In a previous publication[4] we made a preliminary report on a surgical procedure which we employed to clear the pupillary area of some of the opaque tissue in an effort to make available for vision any part of the retina that might not be detached. Unlike typical serous retinal detachment, the detachment in cases of retrolental fibroplasia is not necessarily progressive and complete.

We have a number of older children who have some useful, though quite defective, vision because in one eye the retina remains attached in a quadrant of the fundus and a

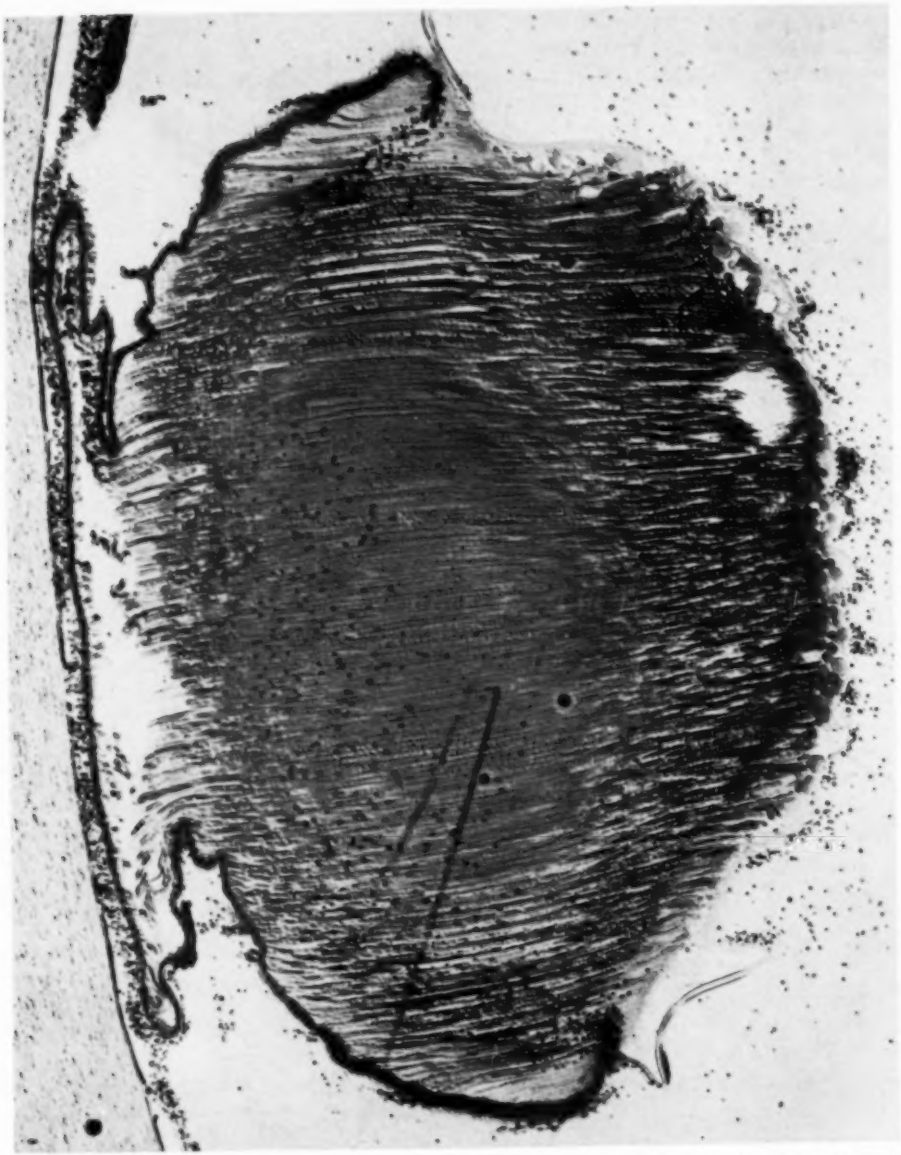


Fig. 18 (Reese and Blodi). A section of the right eye of a premature infant (birth weight, 580 gm.) who died 62 hours after birth. Inflammatory cells infiltrate the iris and are also seen in the pupillary area. In the anterior vitreous, just posterior to the lens, there is a diffuse and marked infiltration of the inflammatory cells. (See Figure 19.)

sufficiently clear area exists in the pupillary region to make this attached retina available for vision (fig. 11). Over an observation period of years we have noted no change in this attached area in the eyes of these children who are now 10 or 11 years of age.

In view of these findings we have attempted to help selected cases by removing surgically enough of the tissue in the pupillary area to permit the use of any partially attached area of the retina. The operation has been performed on 52 eyes and sufficient time has elapsed to enable us to assess the results.

The mean period of our follow-up study has been 12 months, the shortest time being one month and the longest three years. Seven babies could be followed for a period of more than two years and 26 babies for a period of more than one year. Only one case could not be examined at any time after the operation.

In a high percentage of cases (35 of the 52) a considerable amount of straw-colored fluid escaped after incision through the uvea. This fluid was sometimes hemorrhagic, sometimes yellowish or even brown, and may be assumed to have been subretinal in origin and to have contained traces of old hemorrhage. Glistening crystals, which microscopic examination showed to be cholesterol needles, could often be seen in it. In only two instances did true vitreous present itself.

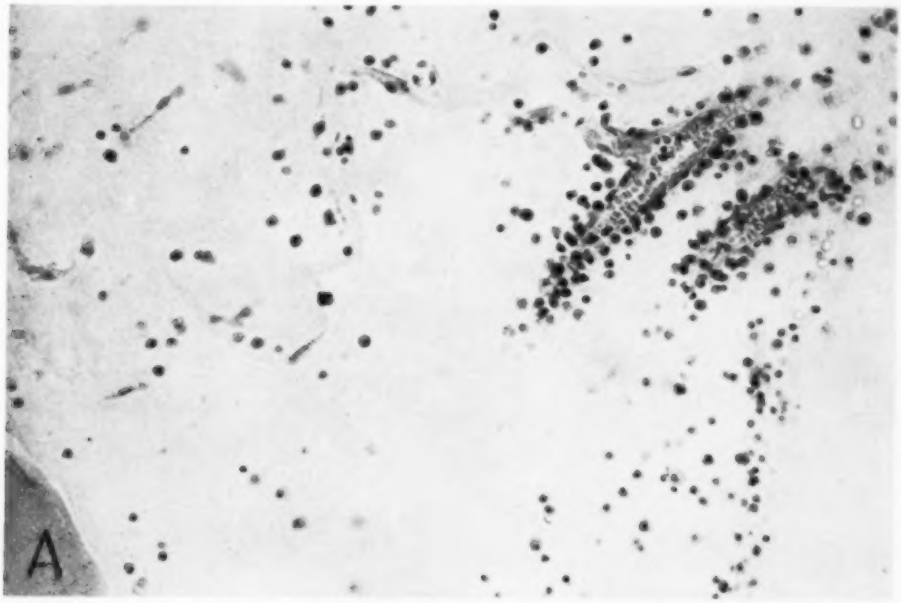


Fig. 19 (Reese and Blodi). A section of the left eye of the same infant as in Figure 18. (A) represents the posterior surface of the lens and just back of this in the anterior vitreous are inflammatory cells around the hyaloid vessels.

The amount of tissue which could be removed varied a great deal. In five cases it was impossible to remove anything at all; in 14 cases the amount excised was minimal or small; in 22 cases it was moderate; and in 11 cases it was relatively large.

Histologic examinations of the excised tissue could be performed in 20 cases. In all of these the biopsy contained retina, often disorganized and degenerated, which in turn

contained hyalin (one case), calcium (one case), and/or pigment (four cases). Half these biopsies showed not only neural tissue but a certain amount of fibrous tissue as well. In one instance lens capsule was found in the section.

The postoperative results can be classified as follows:

1. *No change after operation.* In 27 cases, or roughly 50 percent of the operated eyes, no change could be noted. These eyes showed neither ill effects nor improvement. No relation could be observed between the negative result and the amount of tissue excised during the operation; in some of these cases large amounts were excised.

2. *Situation worse after operation.* In 16 cases the condition was worse after the operation than before. That this deterioration was a result of the operation could be deduced from a comparison of the operated eye with its fellow eye but it must be borne in mind that deterioration as a part of the natural course of the disease can never be excluded.

In five cases numerous posterior synechias developed, indicating a low-grade intraocular inflammation or an intraocular hemorrhage. Except for partial immobilization and disfiguration of the pupil, these synechias were not followed by other complications. In one additional case anterior as well as posterior synechias developed.

In two cases the operation was followed by permanent loss of the anterior chamber, and this resulted in the development of anterior synechias and corneal opacities. Attacks of secondary glaucoma occurred in three cases after the operation but were of brief duration.

In two cases in which cataracts developed postoperatively, we must assume that the

Fig. 20 (Reese and Blodi). A section of an eye of a premature infant (birth weight 2,770 gm.) who died shortly after birth. There is a large retinal hemorrhage in the region of the ora serrata; also, some subretinal hemorrhage. No maceration.

posterior lens capsule was injured during the procedure; this conclusion could be proven microscopically in one instance. In two cases an intraocular hemorrhage was sustained postoperatively with subsequent clouding of the vitreous, and in one case the retrolental tissue appeared to be denser after the operation than before.

These postoperative complications seemed to bear no relation to the amount of tissue excised: even after operations in which no tissue at all was excised, complications occurred (one case each with posterior synechias, intraocular hemorrhage, and densification of the retrolental membrane).

3. *Improvement after operation.* In eight cases the condition improved postoperatively. In each of these it was possible to clear part of the pupillary area to such an extent that not only did a red fundus reflex become visible but the retinal vessels as well (fig. 21). The cleared area was usually an oval or round hole and sometimes comprised a whole segment of the pupil. Although these cases manifested an obvious objective improvement, in no case could we be sure of a functional improvement.

Fig. 21 (Reese and Blodi). The appearance of an eye after excision of the retrolental tissue. Before the operation, the entire pupil was covered by the opaque tissue. The operation has resulted in a sufficient clearing of the temporal half of the pupillary area to permit a view of the fundus. The retinal vessels are visible, as well as some vacuoles in the posterior cortex of the lens.

These results indicate that, whenever the pupillary area is completely covered by a retrolental membrane, the whole retina is de-

tached. It would seem, therefore, that there is little chance of ameliorating the late stages of retrolental fibroplasia by surgery and that any treatment to be effective must be instigated before the irreversible changes have taken place, that is, during the acute or active stage of the disease.

Since the active stage usually occurs while the baby is in the incubator, routine ophthalmoscopic examinations of all premature babies, and especially of those with low birth weights, should be performed in all premature units. The important irrevocable changes first take place in the extreme periphery, and it is this area, therefore, that must be most carefully scrutinized.

Acute stage

So far only two methods have been suggested for treating the acute stage of retrolental fibroplasia:

Vitamin E therapy. In 1948, Owens and Owens[6] advised doses of vitamin E on the basis of the following rationale: (1) Premature babies have defective fat absorption so that a low-fat diet is usually prescribed. A resultant deficiency of fat-soluble vitamins follows depletion of the prenatal storages. Although vitamins A, D, and K are usually supplemented, vitamin E is not. (2) Kinsey and Zacharias[13] have shown that supplementary vitamin A and iron in the diet of premature infants can be correlated positively with an increase in the incidence of retrolental fibroplasia, and it is known that vitamin A and iron increase the requirements for vitamin E. (3) The pharmacologic action of vitamin E as an anti-oxidant could have a beneficial influence on the metabolism of the retina.

It was soon apparent, however, that the premise upon which the treatment was predicated, that is, that retrolental fibroplasia could be a result of vitamin-E deficiency, had to be abandoned. It has been established that vitamin E cannot prevent the development of retrolental fibroplasia, even if given very early, continuously, and with adequate resorption, and that the initial blood level of vitamin E has no bearing on the subsequent development of the disease.

Owens and Owens[14] have now modified their theory. They do not now think that vitamin E has any influence on the incidence of the disease but they still maintain that it decreases the severity of the condition.

The use of vitamin E has been discontinued by us for the following reasons:

1. Retrolental fibroplasia occurred with the same frequency in two series of unselected cases, one treated with vitamin E, the other untreated. This was impressively illustrated in an instance of identical twins in which one twin received vitamin E and developed retrolental fibroplasia and the other twin remained normal without vitamin E.

2. The blood level of vitamin E was found to be from six to seven times higher in the treated infants than in the control series, yet a high blood level of the vitamin has not prevented the disease nor has a low blood level before treatment meant that the child was likely to develop it.

ACTH therapy. After these disappointing results with vitamin E, we explored the possibility of treating the early and progressive stages of retrolental fibroplasia with ACTH.

Since January, 1950, Dr. Frederick C. Blodi and I, together with Dr. W. S. Silverman and Dr. R. L. Day of the Babies Hospital, have administered ACTH to 14 babies affected with retrolental fibroplasia, and the results have encouraged us to continue its use on an experimental basis. The series is still too small to justify either a definite statement of the drug's action in this condition or a recommendation that it be used except under carefully controlled conditions.

The rationale for its use may be summarized as follows:

1. There is good clinical and histologic evidence that retrolental fibroplasia is primarily a disease of the blood vessels, characterized by a dilatation of the existing

blood channels and by their proliferation into the vitreous. It is known that induced hyperadrenalism inhibits the growth of mesenchymal cells, and that cortisone specifically inhibits the growth of capillaries. It seemed reasonable to expect, therefore, that ACTH might halt the vascular overgrowth which marks the beginning of retrolental fibroplasia.

2. In addition to this pharmacologic basis, there may also be a physiologic basis for the use of ACTH in these premature children. There is ample evidence of hyperadrenalism during the last trimester of pregnancy, caused probably by the formation of ACTH and adrenal cortical steroids in the placenta. It is conceivable that these hormones may be necessary for the normal development of the fetus and that premature separation from the maternal hormonal environment has a deleterious effect.

3. We know that retrolental fibroplasia is a self-limiting disease and that it has never been known to develop in an infant older than three months. Since the child must be carried only over this critical period, the length of time during which hyperadrenalism must be induced is relatively short.

The indications for instituting ACTH therapy are to be found in the ophthalmoscopic picture. Only when there are signs of definite and rapid progression, such as retinal edema or retinal detachment, is treatment begun (fig. 22). Dilatation and tortuosity of the retinal vessels, with accompanying fundus hemorrhages, are not considered sufficient indications for starting ACTH in view of the high percentage of spontaneous regressions in this stage of the disease.

Between 20 and 25 mg. of ACTH are administered each day for 14 days. A second course has been given in two cases in which the disease became reactivated after cessation of treatment.

The side effects of ACTH, all apparently temporary, consist of cessation of growth, tachycardia, and glycosuria. The electrolyte

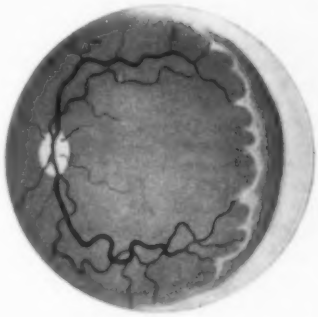


Fig. 22 (Reese and Blodi). A fundus drawing of an eight-week-old premature infant (birth weight, 800 gm.) with early retrolental fibroplasia. The peripheral edema and beginning detachment of the retina are shown. We consider this to be the beginning of the irreversible stage when ACTH therapy should be instigated.

imbalance has not proved troublesome and we do not prescribe low sodium diets. Impurities in the drug have been responsible for alarming vasomotor reactions immediately after injection but to date no harm has resulted from them. The possibility of adrenal cortical derangement due to prolonged overstimulation has been kept in mind although no instances of proven hypoadrenocorticism have been encountered.

In all the patients treated with ACTH the retrolental process has been arrested or has regressed. In none of those treated during the early progressive stage did a partial or complete retrolental membrane develop. Some of the treated infants now have normal fundi; others have a small mass of white tissue far in the periphery of the fundus.

During the same period of time we have had eight infants with progressive retrolental fibroplasia who for one reason or another did not receive ACTH. Three of these now have complete bilateral membranes, three have partial membranes, and two have small masses of white tissue in the periphery of both fundi.

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NEUTRON CATARACTS*

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INTRODUCTION

The production of similar and characteristic opacities of the crystalline lens of the eye by at least three types of radiant energy has been observed and investigated for over 50 years. These have been designated as cataracts due to infrared light, roentgen rays or radium, and electricity. The characteristic early lesions produced in the lens are small punctate opacities along the optical axis in the subcapsular regions of the anterior and posterior cortex.

It is, however, only within the last decade that the production of similar opacities by a new type of radiant energy has been recognized. This has been the observation of cataracts in the eyes of individuals exposed to neutron beams either from the cyclotron or nuclear fission explosions. The practical implications of this have made it imperative that the clinical and experimental investigations of radiation cataracts be prosecuted with vigor.

This paper will attempt to: (1) Review the clinical and experimental studies of roentgen-ray and radium cataracts, (2) present recent reports of the investigations in the field of neutron cataracts, and (3) discuss the possible pathogenesis of these radiation damages in the lens.

ROENTGEN-RAY CATARACTS

Presumably the first observation of cataracts produced by roentgen rays was that of Chalupecky in 1897, two years after Roentgen first identified these rays. He noted marked changes in the anterior segment of eyeballs of rabbits exposed to roentgen rays, but he did not observe them long enough for opacities to develop fully.

The numerous reports in the following years described the general characteristics of roentgen radiation cataracts. These were the development of punctate opacities in the subcapsular region of the cortex, usually after a variable latent period, which became progressive after very heavy exposure and produced total cataracts. Opacities produced by infrared light and by electricity were recognized as separate entities with their distinctive characteristics.

There were numerous clinical reports of roentgen-ray cataracts in the early years because of the unrecognized danger. This was due chiefly to the long latent period. Lebensohn, in 1932, stated that 50 cases had been reported in the literature, and Clapp collected and reported 34 of these in the same year. All of the cataracts occurred as complications of irradiation treatment of various conditions about the eye such as lupus, eczema, acne, carcinoma of the lid, and so forth.

These reports showed that the latent period varied from nine months to 12 years (Milner, 1934), and delineated the chief characteristics as seen with the slitlamp. There was, first, the development of fine opacities in the posterior cortex just beneath the capsule. Later, vacuoles and streaks were seen to form a saucerlike opacity in the posterior cortex whose anterior and equatorial borders were sharply limited. There were one or more layers to the disc, so that from the front they appeared as concentric rings. Less marked vacuoles and streaks were seen in the anterior subcapsular areas.

The fact that there was no universal standard for measurement of intensity of roentgen radiation in the early years left many questions unanswered concerning the exact exposure required to produce these cataracts.

Leinfelder (1936) attempted to answer some of these questions by accurately reporting the clinical and histopathologic changes in his cases of radiation cataract. From these

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studies he found that the first damage was in the fibers in the posterior subcortical region. The amount of damage, the extension anteriorly, and the progressiveness all depended on the total dosage and length of the ray. He concluded that 600 r of rays filtered through 0.5 mm. Cu plus 1 mm. Al, in the age group 40 to 60 years, was least likely to produce cataracts. An average of 2,700 to 4,000 r of unfiltered rays would likely produce damage in any age group.

There were still many questions to be answered by experimental investigations. Numerous animal experiments performed by Aulamo (1931), Rohrschneider (1929), Peter (1930), and Desjardins (1931) demonstrated that the young lens is the most susceptible to radiation; the anterior epithelium is damaged first; soft rays are most damaging; and 1,000 r would produce a complete opacity in the rabbit after 130 days.

More detailed and analytical experiments were undertaken by Leinfelder and reported in 1936. He exposed rabbits to various dose levels on different schedules and then examined their eyes histologically. The lens showed most damage in the equatorial areas, swollen fibers in the subcapsular areas of the cortex, and some rabbits suffered damage to the anterior epithelial cells. From these experiments he concluded that single doses of long rays are most likely to produce changes and repeated small doses of short rays are the least likely.

The most recent experimental studies were those done by Poppe (1942). He exposed 34 rabbits to 1,500 r produced by 175 kv with a 4 ma. current. Filtration was 0.5 mm. Cu plus 3 mm. Al; distance from target, 28 cm. After stated intervals of exposure, the eyes were removed and whole mounts made of the total lens epithelium and anterior capsule. In normal mounts he described three concentric zones of epithelial cells.

The peripheral zone near the equator was made up of large oval cells, with large dark oval nuclei and these ordinary cells from the fibers. The intermediate zone was made up of a mixture of cells showing a transition from the peripheral zone, through a characteristic zone of peculiar star-shaped cells, to the central zone. The cells in this central zone near the axis of the lens had abundant clear cytoplasm, large nuclei, and were polyhedral in shape. Mitotic figures are normally found in 0 to 10 cells in the outer middle zone only.

He reported the following results: After 24 hours, there was sporadic vacuolization of the cytoplasm and pyknosis of nuclei in the equatorial region. Suppression of mitoses also occurred in this region. After two days, vacuolization was noted in the star cells and ordinary cells of the middle zone. After four days, these vacuoles were progressing, forming signet ring cells. Within six days abnormal detachments of the nuclear chromatin were occurring, forming accessory nuclei in the anterior equatorial regions. Mitoses also began to reappear at this stage. By ten days there were progressive irregular mitoses with accessory nuclei in the ordinary epithelial cells, and vacuoles in both ordinary and star cells.

The fibers first showed changes at one month. These were swelling, vacuolization, and retained nuclei in the equatorial regions. After four months, there were many monstrous nuclei, multiple and accessory nuclei in the ordinary cells. Cataracts could be clinically observed at this stage. The vacuolar degeneration had slowed or stopped. By 14 months the anisocytosis and poikilocytosis of the epithelial cells was marked both in the peripheral and central regions.

It is evident from these studies that 1,500 r of hard rays is sufficient to produce cataracts, and apparently does so by damaging the fiber-producing cells of the anterior epithelium.

A summary of these observations and investigations presents the modern view of roentgen-ray cataracts. The primary damage appears to be in the actively proliferating cells of the anterior epithelium. These cells then produce abnormal fibers, which, after

a latency of nine months to 12 years, produce opacities in the subcapsular areas. The total dosage necessary to produce these changes is between 1,500 and 2,000 r, and long rays are more damaging. The larger the dose the more tendency there is to produce a progressive total cataract. Finally, all roentgen-ray cataracts should be preventable by using proper shielding, filtration, and low dosages in treatment of lesions around the eye.

Neutron cataracts

The relative complacency produced by the knowledge of how to prevent roentgen radiation cataracts in irradiation clinics was abruptly destroyed by the first nuclear fission explosion in Hiroshima. This momentous explosion liberated fission fragments, neutrons, beta particles, gamma rays, heat, ultraviolet, visible, and infrared light. It will be noted that included in this list are two forms of radiant energy already described in this paper as capable of producing cataracts. However, there was a third form of radiation liberated which could produce cataracts, but very few were aware of this at that time. This radiation was that of the neutron particle.

The neutron was identified in 1932. It has a mass equal to that of the hydrogen nucleus, has no charge, and exists in nature in the nuclei of atoms, with the exception of the hydrogen atom. It is released from these nuclei by the bombardment of high-energy particles such as photons or deuterons. Its two common means of production are by the cyclotron and the nuclear pile. Neutrons were used in irradiation therapy on patients from 1938 to 1943, but no cases of cataract were reported during that time.

The first cataracts reported which might have been caused by neutrons were those found after the atomic-bomb explosions in Hiroshima and Nagasaki in August, 1945. Since gamma rays and infrared light were also released at these explosions, it cannot be accurately known what part they played in the production of these cataracts. However, there were certain clinical and histopathologic characteristics that suggested some different form of radiant energy may have played a part.

Ikui (1946) examined 48 eyeballs of 29 individuals who had died 20 to 40 days after the bombing; 11 were male and 18 female; the youngest was aged seven years and the oldest 66 years. The chief findings were extensive hemorrhages in the nerve-fiber layer and a diffuse septic chorioretinitis. These were attributed to the pancytopenia produced by the lethal radiation. Changes in the lens were less marked, but in several cases the nuclei of the cells which lay beneath the capsule at the equator were shriveled and some of them were degenerated. In the posterior subcapsular region, the lens fibers were swollen and disintegrated in a very thin layer continuous with the posterior extension of the equatorial changes. Beneath the anterior capsule small vacuoles were found. In a clinical examination of 330 patients between 2 and 20 days after the bombing, no changes in the lens were found.

Schlaegel (1947) reported on his examinations of the eyes of individuals dying with radiation sickness and aplastic anemia 27 to 30 days after the explosion. These patients all had received an epilation dose of radiation.

Larkin (1946) calculated that within 1,000 meters of the hypocenter there was a lethal exposure of heavy penetrating radiation, mostly neutrons and gamma rays. Between this and 1,250 m. the radiation was mostly gamma rays and was calculated at 473 r/cm^2. From 1,250 to 1,500 m. the gamma radiation was calculated at 202 r/cm^2. In both these latter zones epilation was produced, and there was a marked fall in all peripheral blood cellular elements. In all zones superficial burns were produced by ultraviolet, infrared, or heat waves.

From these calculations Schlaegel concluded his patients were within the 1,250 m. zone, and received heavy exposures to gamma and neutron radiations. Examination of the eyes with the ophthalmoscope revealed

no cataracts. Histologic preparations, however, showed vacuoles in the anterior and posterior subcapsular areas, and in the more advanced lesions these had coalesced to form plaques.

These changes in the lens cannot definitely be ascribed to any one of the three forms of radiation; however, in general the changes after exposure to neutron beams were reported (table 1).

The calculated exposures were estimates of the individual scientist, and based on the ionization produced by neutron beams in 25-r Victoreen chambers. It was noted that most of the injuries were due to chronic exposures to neutrons in the 0 to 10-mev range.

TABLE 1

RESULTS OF THE EXAMINATION OF THE EYES OF 10 PATIENTS WHO HAD DEVELOPED LENS OPACITIES AFTER EXPOSURE TO NEUTRON BEAMS (FROM A SURVEY MADE FOR THE NATIONAL RESEARCH COUNCIL, 1949)

Patient	Probable Date of Exposure	Total Exposure to Neutrons "N" Units	Duration of Exposure in Weeks	Slitlamp Examination (January, 1949)
1	1944	135	200	Saucer of disclike opacities in posterior cortex; slight subcapsular anterior cortical haze; vision markedly reduced
2	1943–44	75	12	
3	1943–44	75	12	
4	1941–47	10– 40	250	Slight changes in posterior cortex; white opacities tending to saucer or disc; slight haze in anterior cortex
5	1947–48	30–100	10	
6	1947–48	20–100	30	
7	1943–44	1– 25	12	
8	1939–42	70	100	Thin lacy opacity in posterior cortex; occasional punctate dots; capsular iridescence; considered doubtfully pathologic
9	1947–48	4–25	10	
10	1938–40	15	80	

TABLE 2

RESULTS OF EXAMINATION OF THREE PATIENTS KNOWN TO HAVE BEEN EXPOSED TO CYCLOTRON BEAMS

Patient	Age (Yrs.)	Date of Exposure	Type of Exposure	Time Elapse before Exam. (Yrs.)	Slitlamp Examination	Visual Acuity			
						Uncorrected		Corrected	
						L	R	L	R
1	24	1943–44	Cyclotron	2–3	Fine, frosty, mold-like opacities in posterior cortex	20/25–2	20/50	20/40–2	20/50–2
2	37	1941–42	Cyclotron, poor protection to irradiated material	7–8	Increased graying in lines of optical dysjunction between posterior cortex and adult nucleus	20/200	20/200	20/16–1	20/16–1
3	35	1940	Cyclotron	9	Anterior and posterior fine punctate opacities, bilateral	20/15–4	20/15–3		

occurred much earlier than those found after roentgen radiation alone.

There have been recent reports of cataracts known to have followed exposure to neutrons from a cyclotron source. In a re[illegible] of the radiation-cataract survey made [illegible]he National Research Council (1949), [illegible] results of the examination of the eyes of [illegible]0 patients who had developed lens opacities The cumulative exposures showed a median dose of 50 "N." The severe cases did not fully develop until three years after exposure, so that some of the men more recently exposed might be expected to show damage later.

In a similar survey of workers at the Argonne National Laboratory conducted by The University of Chicago Clinics, Division of

Ophthalmology, in April, 1949, and June, 1950, five cases with lens opacities were found. Three of these occurred in persons known to have been exposed to cyclotron beams (table 2).

Patients 1 and 3 had undoubtedly been exposed to neutron radiation, but no attempt was made to estimate the actual exposure. The unreliability of memories and the unknown quantitative relationships between units of neutron radiation and histologic effects were felt to make this an insignificant omission. Patient 1 received a very severe exposure, as measured by the short latency and the fact that his opacities progressed rapidly enough in the year following examination to require surgical treatment.

TABLE 3

RESULTS OF SURVEY OF WORKERS AT THE ARGONNE NATIONAL LABORATORY CONDUCTED BY THE UNIVERSITY OF CHICAGO CLINICS, DIVISION OF OPHTHALMOLOGY, APRIL, 1949, AND JUNE, 1950

Patient	Age (Yrs.)	Date of Exposure	Type of Exposure	Time Elapse Before Exam. (Yrs.)	Slitlamp Examination	Visual Acuity			
						Uncorrected		Corrected	
						L	R	L	R
1	30	1940–49	Built several Van der Graaf machines. Slight exposure to X-radiation	0–9	Rt.-post. adult nuclear opacities. L.-punctate opacities	20/40 +2	20/40	20/15 −3	20/15 −4
2	34	1941–43	Cyclotron and Van der Graaf exp. Developed conjunctivitis	6–8	Normal		5/200	20/15 −5	20/15 −2
3	34	1939–41	Cyclotron. Exposed to samples 6–8 ×	8–10	Normal	20/16 −2	20/16 −4		
4	35	1937–39	Cyclotron. In machine while operating	10–12	Normal	20/200	20/200	20/16 −3	20/25 +4
5	30	1944–48	Gamma exposure from radioactive material	1–5	Normal			20/50 −1	20/25
6	29	1943–44	Cyclotron. Little exposure to irradiated material	5–6	Normal	20/13 +3	20/13 −2		
7	39	1942–43	Cyclotron. Good protection	6–7	Normal	20/15	20/15		
8	30	1944–49	Radioactive material—high doses past four years	0–5	Normal	8/200	10/200	20/13	20/16 +4
9	26	1946–49	Moderate exposure to hard and soft gamma radiation, 0.5 r highest	0–3	Normal	15/200	15/200	20/16 −3	20/16 −2
10	42	1941–44	Cyclotron and irradiated material	5–8	Normal	20/20 +1	20/20 +2		
11	31	1944	Cyclotron. Poor protection	5	Normal	10/200	10/200	20/16 −1	20/16 −3
12	27	1943–44	Cyclotron. Little exposure to irradiated materials	5–6	Normal	20/15 −2	20/15		
13	34	1941 1948–49	Cyclotron, pile, below 0.1 r exposure	8 1	Normal	20/30	20/20	20/15	20/15
14	26	1947–49	Cyclotron. Over exposure several times with badge	0–2	Normal	20/15 −3	20/20 −3		
15	32	1946	Radioactive material		Bilateral posterior subcapsular changes	20/50 +3	20/50 +3	20/20 −3	20/100
16	27	1944 2 weeks) 1947	Cyclotron. Very little exposure	2–5	Normal	20/15 −1			

The 16 remaining patients examined in this survey are reported in Table 3.

It can be seen that the two patients reported in Table 3 who were found to have lens opacities were exposed only to roentgen

or gamma radiation. The negative examinations of the lens in the remainder were felt to be significant insofar as all patients were working with radiation sources only in recent years and show the effects of better protection, more care in avoiding overexposure, and, possibly, the length of the latent period.

As in the case of roentgen-ray cataracts, these early clinical observations leave many questions unanswered regarding the exact exposure needed to produce the opacities. There has been a small amount of investigative work done in this field, but most of it remains to be done.

The first problem was to establish a standard of measurement of neutron radiation similar to the roentgen unit of roentgen rays. Since neutron beams produce ion pairs after absorption by the target atoms, the same principle of measurement could be applied to them as was used for roentgen rays. Arbitrary "n" units were then set up, using the scale of the 100 r Victoreen chamber; and with 25 r chambers, the unit is expressed as "N." However, since the neutron beams were going to be acting on tissues and not on air, it was necessary to establish a relationship between the ionization produced in air and that in tissues.

Aebersold (1946) proceeded to do this by measuring the absorption of fast neutron energy in gases, walls, and tissues. He defined a unit, the roentgen equivalent physical (r.e.p.), in terms of the energy absorbed per gram of tissue from exposure to 1 r. He then showed that 1 "n" was equivalent to 2.5 r.e.p. Stone (1948) pointed out that it is very important when comparing the effects of exposures to neutrons with those of roentgen rays to use those units which express the energy absorbed by the tissues, rather than the units which express the energy absorbed by air.

Hence, whereas the ratio between the number of r and the number of "n" required to produce a given biologic effect might be expressed as 50/20, actually, in terms of the energy absorbed per gram of tissue, it is 50/50 (1n = 2.5 r.e.p.). A ratio such as 50/20, therefore, gives an erroneously high impression of the actual difference between the effects of the two radiations on tissues.

To complicate the subject further, this ratio of the roentgen equivalent physical effect of roentgen rays to the roentgen equivalent physical effect of neutrons (expressed as $4/n \times 2.5$) is different in the various tissues. Thus the ratio in the effects on chick embryo fibroblasts is 0.8, which means the roentgen rays have a greater biologic effect per unit of absorbed energy. The ratio of the effect on hatching Drosophila eggs is 1.24, at 4.5 hours, and on mouse sarcomas it is 20. Here the neutrons have the greater biologic effect per unit of absorbed energy.

Unfortunately, most of the investigators of the effects of neutrons and roentgen rays on tissues have used the r/n or the r/N ratio. Therefore, in reading these reports, the above should be kept in mind, along with the fact that 1.5 n = 2 N.

The investigations of Evans (1948) have given the most detailed information on the possible effects of neutrons on the crystalline lens and the r/N ratio in radiation damage. He first conducted an acute experiment to determine the ratio between the lethal doses of neutron beams and roentgen rays on mice.

CF, strain mice were exposed to a 180 degree beam of neutrons, 28 inches from the source, through a three-inch lead filter. The various doses were expressed as N units, using the 25 r chamber. Other mice were exposed to 185 kv. roentgen rays filtered through 2 mm. Cu plus 1 mm. Al at 56 cm. from the portal. Exposure was at the rate of 10 r/minute. From this he found that 630 r killed 50 percent of the mice, whereas only 78 N were required. This is a ratio of 8.1/1. He also found that the same ratio held in the reduction of mean survival time, leukocyte count, and hemoglobin content of blood. In a subacute experiment 10 N and 80 r were found to have the same effect on survival rate, leukopenia, hemoglobin, erythrocytes,

and damage to gonads, spleen, and bone marrow.

Evans then conducted chronic experiments in an attempt to find what the maximal safe exposure to neutrons would be. It had been accepted that the maximum safe exposure to roentgen rays was 0.1 r/8-hour day/5.5-day week. Using the 8/1 ratio he had found, this would be equivalent to 0.014 N.

He then set up experiments using groups of 25 animals of CF. strain mice, Swiss strain. These were divided into male and female groups. Each group received its respective daily dose until 50 percent of the group had died. Dose 1 was 0.014 N; dose 2, 0.07 N; dose 3, 0.14 N; and dose 4, 1.4 N. The effect on mean survival time, body weight, leukocytes and differential count, platelets and clotting time, estrous in females, fertility in both males and females, and opacities in the lens were then recorded.

Examination of the eyes with the slitlamp showed opacities in eight percent of the Dose-1 group, 32 percent of Dose 2, 85 percent of Dose 3, and all the animals in Dose 4 group surviving became totally blind. At the Lethal Time 50 for Group-4 animals, visible opacities were present in all survivors. Histologic examination of the eyes affected showed degeneration of the anterior epithelium and autolysis of the lens fibers.

A comparison of the effects of daily doses of 1.4 N and 11 r (100 × maximum safe r) showed that the neutrons produced more cataracts and greater damage to gonads. The roentgen rays had a greater effect on the peripheral cellular elements of the blood. From this Evans concluded that the ratio of r/N in production of cataracts by chronic exposure was greater than eight and possibly as high as 40. He felt that his experiments showed a specific sensitivity of the lens to neutrons. Henshaw (1947) reported a ratio of 7.5/1 (r/n) in acute experiments on mice, and with small daily doses the ratio was 35/1.

Stone (1948), reporting on the use of neutron beams in the treatment of various neoplasms of 24 patients, showed that the biologic effect of neutrons was greater than that of roentgen rays, and the difference was even more striking in chronic exposures. He estimated an r/n ratio of 2.5 for a threshold skin reaction, and this increased to four when late skin changes were compared. The chronic effect of shortening the life of patients treated with repeated daily doses was 15/1.

It is apparent there is a marked quantitative difference between the effect on tissues of neutrons and roentgen rays which may have a similar ionizing effect on molecules of air. This has been suggested as possibly due to the different specific ionization effect. Specific ionization is a term used to denote the ratio of the number of ion pairs formed to the length of the ionization track. The more ion pairs formed per unit length, the more is the specific ionization. Neutrons transfer their energy to protons of the target nuclei, which in turn produce ion pairs along their track. Since protons have a greater density than electrons (which are liberated by photons of roentgen rays), they produce more ions in a shorter path. Thus, the spatial relations of ions produced by neutron and roentgen irradiation are different. This greater specific ionization appears to produce a greater biologic effect (Stone, 1948).

Also, it has been shown by Marshak (1942) that there is a difference in the effect of the two types of radiation on different cells. She showed that neutrons caused more damage on resting cells, causing primary degeneration. Roentgen rays, in turn, had a greater effect on cells undergoing mitosis. Thus, repeated chronic exposure to neutrons could tend to damage both resting and proliferating cells. This might explain the shorter latency in the development of neutron cataracts, and the fact that primary damage to the lens fibers is found concurrently with damage to the epithelial cells.

A third qualitative difference between neutron and roentgen rays appears to be the amount of energy absorbed from the radiation which goes toward ionization. With

neutrons, only 50 percent of the energy goes toward ionization; the remainder is left to cause phenomena such as disruption of molecular bonds and the inducing of chain molecular reactions.

In summary, the chief differences between cataracts produced by neutrons and those produced by roentgen rays seem to be: (1) The shorter latent period needed for neutrons; (2) the larger equivalent dose of roentgen rays necessary; (3) the greater specific ionization presumably produced on the lens; (4) the greater effect of neutrons on resting cells, which may correlate with the earlier production of fiber pathology.

The chief similarity between the two is the fundamental histopathology of the opacities.

Pathogenesis

The foregoing discussion of the three or four different types of radiation causing lenticular opacities has been relevant because of the remarkably similar damage produced on the lens. This is even more significant because it can be separated out both clinically and histologically from the numerous other types of lens opacities.

The primary effect of radiation appears to be on the highly metabolic anterior epithelial cells and the young fibers they are producing. Since these new fibers grow around the cortex immediately under the capsule, it is not difficult to understand why the earliest changes should be seen here with the slitlamp. Since these fibers are produced by the equatorial anterior epithelial cells, it also helps to understand why the first histopathologic changes are found there. However, this only leads to the more fundamental question of the mechanism of the damaging effect of radiation on these cells. The remainder of this paper will be devoted to a discussion of recent studies of the mechanism of action of ionizing radiation that are related to the crystalline lens.

Fricke (1934) was one of the first investigators of the physical and chemical foundations for the biologic effect of roentgen rays. He thought it was mediated through the formation of H_2O_2 in the irradiated water surrounding the cells. Weiss (1940) further elaborated this scheme and presented equations showing how OH^-, O_2H^-, O, and H_2O_2 could be liberated by the action of roentgen rays passing through water. All of the above radicals are powerful oxidizing agents. Laiseleur (1941) also believed from the result of his investigations that the primary effect of radiation in aqueous solutions was due to H_2O_2 formation.

It was with this background that Barron undertook his studies of the mechanism of action of ionizing radiations. In general he had observed that roentgen rays could exert a biologic effect either through breaking H bonds and denaturing proteins, by disrupting prosthetic groups, or by the oxidation of sulfhydryl (SH) groups by the oxidizing radicals of irradiated water. He then undertook to investigate this latter possibility.

He first presented the following equations for the possible reaction of compounds containing SH groups with the oxidizing agents of irradiated water. These are:

$$2\,RSH + 2\,OH^- \rightarrow RS - SR + 2\,OH^- + 2\,H^+ \quad (1)$$
$$2\,RSH + H_2O_2 \rightarrow RS - SR + 2\,H_2O \quad (2)$$
$$2\,RSH + 2\,O_2H^- \rightarrow RS - SR + 2\,H_2O_2 \quad (3)$$
$$2\,RSH + 2\,O \rightarrow RS - SR + H_2O_2 \quad (4)$$

He then measured the inhibition of enzymatic activity of SH-containing enzymes by irradiation, and compared this with the effect on non-SH-containing enzymes. Where he obtained an inhibition, he attempted to reverse it by the addition of glutathione which replaces H on oxidized SH groups.

The results on the SH-containing enzymes are shown in the table at the top of the next page.

This shows that there is an increasing inhibition of enzymatic activity with increasing doses of roentgen rays, and that this inhibition can be in turn reversed by the addition of glutathione. The inability of the GSH (glutathione) to reverse the inhibition produced by the higher doses to the extent it reversed that produced by the lower is attributed by Barron to direct denaturation of proteins by the high doses.

Dose in r	Inhibition %	% Reactivation with Glutathione
I. Phosphoglyceraldehyde dehydrogenase		
100	21	Complete
200	50	62
500	94	10
II. Adenosinetriphosphatase		
10	10%	
100	32	64
1,000	95	22
III. Succinoxidase (amount varied, dose constant at 5,000 r)		
0.2–0.4 cc.	7–10%	
0.1 cc	29	
0.05	Complete	
0.05+glutathione	23	
0.05+glutamate	62	
0.06	77	75

The effect of roentgen rays on non-SH-containing enzymes showed some inhibition of trypsin and ribonuclease with no reactivation by GSH. There was no inhibition of lactic dehydrogenase, cytochrome, oxidase, or catalase.

Carrying his investigations to living cells, Barron observed the effect of roentgen rays on the respiration of sea urchin sperm cells. These showed a range of 66 percent reduction of the QO_2 after receiving 20,000 r to a 10-percent reduction after 100 r. Furthermore, in solutions containing succinate, an acetate substrate, the inhibition was doubled over the control solutions. However, he did not feel that this inhibition was mediated through the oxidizing effect of H_2O_2 on the SH groups since H_2O_2 actually increases sea urchin sperm respiration.

The possible relation of these fundamental studies to the production of cataracts in the lens can only be understood after a brief review of the normal makeup and physiology of the lens which is pertinent to this subject. For much of the following discussion, the material presented by Bellows (1944) has been drawn upon heavily.

The normal lens has been found to have a very high glutathione content; in fact, higher than any other tissue. This exists mostly in the reduced, or GSH, form. The oxidized form is represented as GS-SG (Rosner *et al.*, 1938). It varies with age, rising in the rat to a peak at 150 days, then leveling off. It is also two to five times greater in amount in the cortex than in the nucleus. Krause (1933) reports a high content of SH groups in the lens, which seems to be chiefly in the beta crystalline component of the lens proteins. This is a soluble protein in the cortex, contrasted with the albuminoid insoluble protein in the nucleus.

The normal metabolism of the lens presents an interesting study since it consists of an island of tissue in a sea of aqueous humor, with no blood vessels or connective tissue. The cortex is responsible for most of the O_2 uptake (Field, 1937), and this decreases with age as the nucleus enlarges. The production of energy from the metabolism of carbohydrate differs from that of other tissues in that it is chiefly anaerobic. Six times as much glucose is converted to lactic acid as to carbon dioxide (Kronfeld, 1928). The capsule is reported to be the most actively glycolytic, and this is presumed to be due to the presence of epithelial cells.

The anaerobic and aerobic cycles for the breakdown of glucose in the lens are similar to those in other tissues insofar as they have been investigated. There is a notable exception to this, however, in the final transfer of H from metabolic substrate to O_2. Cytochrome and cytochrome oxidase are reported to be absent; flavoprotein, if present, is so in very minute amounts (Euler and Gunther, 1938); succinic dehydrogenase is present in very small amounts (Adams, 1925). Malic and citric acids and their dehydrogenases have been reported by Krause (1939).

Because of the sparsity of the usual hydrogen carriers in the carbohydrate cycle, interest was centered on the mechanism in the lens. Adams and Rosner (1938) found that metabolism of the lens and O_2 uptake were markedly dependent on a thermostabile residue, later shown to be beta crystalline and glutathione. Without glutathione there was no respiration of a lens emulsion, and

glutathione required the presence of the thermostabile residue in order for respiration to be normal. From these facts, these workers postulated that in lens metabolism the final pathway of the H^+ from substrate to O_2 was from beta crystalline to GS-SG, which became GSH, and then passed the H^+ to ascorbic acid, which in turn passed it on to oxygen.

Krause, however, criticized this theory, and felt that glutathione had very little to do with respiration of lens tissue. Rather, he thought its role might be that of a coenzyme for protein synthesis, or for maintenance of SH groups on enzymes, or for detoxification.

The relation of these facts about normal lens metabolism to the production of radiation cataracts is apparent when one considers the investigations of Barron. We have seen that the respiratory activity, glutathione, and beta crystalline are all concentrated in the cortex of the lens. The epithelial cells, which are presumably the most metabolic structures in the lens, are also in the subcapsular area of the cortex. The first signs of radiation damage are in these areas. Furthermore, Jess showed in 1934 that the glutathione content of the lens extracted for radiation cataracts was significantly reduced.

In the light of these facts the following possibilities present themselves for consideration in the pathogenesis of radiation cataracts:

1. Radiation may produce oxidizing agents in the aqueous which oxidize the glutathione in the postulated final H^+ carrier system. Direct ionization of the enzyme through collision with the ionizing irradiation is unlikely.

2. The above oxidizing agents could inhibit the activity of SH-containing enzymes in the carbohydrate cycle.

3. SH-containing enzymes for protein synthesis and cell proliferation could be inhibited.

4. Proteins could be denatured directly. Inhibition of nonsulfhydryl enzymes, such as catalase and ribonuclease, may be attributed to protein denaturation.

Any of these effects would certainly produce changes in the metabolism of the epithelial cells which could lead to the early histopathologic change noted there by Poppe —that is, vacuoles, swelling, and abnormal mitoses.

A possible explanation for the production of opacities and of vacuolar swelling would be: The inhibition of SH enzymes, such as phosphoglyceraldehyde dehydrogenase, or the oxidation of glutathione in the proposed H^+ carrier system would lead to an accumulation of acid radicals lowering the pH of the lens from its normal of seven. Beta crystalline would then tend to precipitate as it neared its isoelectric point of pH 6. This would produce opacities. Also, beta protease is activated around pH 5 which attacks beta crystalline breaking it down into its amino acid residues. The increase in osmotically active particles could lead to swelling and vacuoles.

It is obvious that, before these theories can be proven or disproven, much additional information about the normal metabolism of the lens must be obtained. However, there is one practical possibility suggested by these theories which might prove useful. This would be an attempt to see whether radiation damage to the lens could be prevented by the injection of glutathione or other reducing agents into the aqueous humor of animals before and/or after exposure to neutrons or roentgen radiation.

Summary

This paper has reviewed the clinical and experimental investigations of roentgen and neutron radiation cataracts. The following main points have been presented:

1. Both these forms of radiant energy primarily damage the anterior epithelial cells of the lens cortex, which in turn produces abnormal fibers leading to opacities in the subcapsular regions of the cortices.

2. Neutrons produce more damage per

unit of absorbed energy than roentgen rays. This probably produces a shorter latent period.

3. The oxidation of sulfhydryl groups on the enzymes of normal lens metabolism is presented as a possible mechanism for the biologic effect on the lens structure.

4. Future investigations should be directed to working out: (a) Exact data of exposures of neutrons required to produce cataracts; (b) the specific effect of radiation on normal lens metabolism; (c) methods of prevention both before and after exposure.

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HEALING OF INCISIONS FOR CATARACT EXTRACTION*

THE SIXTH SANFORD R. GIFFORD MEMORIAL LECTURE

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I sincerely appreciate this great honor you have bestowed upon me. To pay homage to the memory of Dr. Sanford R. Gifford is indeed a privilege. His scientific achievements are familiar to all, and each and every one of you know his humane nature. In his brief but full life he carved his name high on the portals of ophthalmology. Through his untiring efforts and utter devotion to the advancement of our specialty he deservedly won widespread recognition. While he was an investigator, his chief interest lay in the practical application of scientific facts. It is with this thought in mind that I have selected "Healing of incisions for cataract extraction" as the subject for discussion.

During the past 25 years, many of the complications of cataract surgery which vexed earlier ophthalmologists have been fairly satisfactorily controlled. One such problem is that of healing of the cataract section. Such catastrophic events as eversion of the cornea have been largely eliminated, but there remain less obvious consequences of imperfect wound healing which may lead to late complications. For a clear understanding of the importance of these inconspicuous imperfections it is necessary to consider how healing takes place under normal and abnormal conditions.

NORMAL HEALING

Our present concept of the healing of cataract sections is much the same as that held 35 years ago. It is recognized that the healing process of a corneal incision differs from that following a corneoscleral incision with a conjunctival flap. In 1914, these differences were well described by Tooke[1] and also by Treacher Collins.[2]

It is generally accepted that, after a smooth linear corneal section without a conjunctival flap, the corneal lamellae swell because of imbibition of fluid, presumably aqueous. At the same time the anterior and posterior layers of cornea, which are normally under tension, tend to retract. The central lamellae thus come into apposition leaving a triangular area of gaping both posteriorly and anteriorly.

According both to Weinstein,[3] who studied Saemisch sections in dogs, and to Tooke, who worked with rabbits, the posterior triangle soon becomes filled with fibrin from the secondary aqueous. This statement has been repeated by others including Collins and Henderson.[4] The latter however also stated that, although he believed this fibrin was derived from the secondary aqueous, the possibility of its arising as a transudate from the corneal lamellae had to be considered.

Weinstein reported that within a few days the endothelial cells cover this posterior plug and, in time, produce a new Descemet's membrane. More slowly, cells appear along the stromal edges of the wound. The exact source of these cells is not certain but it is usually accepted that they are the result of migration and proliferation of stromal cells of the cornea. As these cells appear in greater numbers they arrange themselves in irregular layers and gradually fill the posterior triangle causing disappearance of the fibrin plug.

When the incision is corneal, the larger anterior triangle is rapidly filled with epithelial cells. At first this is a mechanical process but later karyokinetic activity and consolidation occur.[5] Eventually, by a process similar to that occurring in the posterior triangle, irregularly arranged corneal lamel-

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lae push the epithelial plug upward until the corneal layering is approximately normal.

According to the literature the difference between healing with and without a conjunctival flap is in the processes that take place in the anterior triangle. When there is a conjunctival flap, the epithelium is prevented from entering this wedge-shaped space. It is filled by a fibrinous exudate derived from the subconjunctival and episcleral vessels.

This coagulum which soon causes adherence of the flap to the underlying tissues, later becomes reinforced by an ingrowth of fibroblastic connective tissue and a variable number of blood vessels. Such growth has been demonstrated by Tooke in a rabbit two days after operation. Henderson found it well advanced in human eyes by the seventh postoperative day.

This connective tissue later contracts and is slowly replaced by corneal lamellae. The duration and extent of this process depend not only upon the amount of gaping of the wound but also upon the degree of the inflammatory reaction.

This generally accepted concept of wound healing has recently been questioned by Maggiore[6] and Purtscher.[7] These investigators showed the microscopic findings in eyes removed at varying intervals after cataract extraction. In both reports, healing appeared to pursue a similar course.

Purtscher after studying eyes removed 3, 9, and 14 days postoperatively came to the conclusion that a corneoscleral wound heals primarily from the episcleral tissues. He believes the conjunctival flap first becomes adherent to the underlying tissue by means of fibrin from the episcleral vessels. Since these vessels are most numerous at the limbus, the fibrinous adhesion is strongest at this site. This is the condition three days postoperatively when no reaction is observed except on the scleral side of the wound. At this stage an epithelial plug has already filled the anterior triangle at those areas with no conjunctival flap.

Purtscher also contends that healing continues from without inward and is accomplished nearly entirely by proliferation of episcleral connective tissue through the lips of the wound.

This is a slow process for, at the end of 14 days, the scar tissue has reached only the middle third of the incision. The corneal stroma and endothelium as yet have taken no active part in the healing. By the 14th day only a few endothelial cells are present in the wound.

One may conclude from Maggiore's specimens that it is not until about a month after operation that the corneal lamellae and endothelium proliferate and final healing takes place.

Vail[8] in commenting upon the slowness of these reparative processes states that at least two months are required for permanent union.

Experimental study

Through animal experimentation, an attempt was made to reconcile these differences in thought on the mechanism of early wound healing. For these studies, cataract incisions with and without conjunctival flaps, were made on a series of Rhesus monkeys (macaca mulatta). The wounds were closed with appositional corneal or corneoscleral sutures. The eyes were removed from 2 to 6 days postoperatively and serially sectioned.

These investigations support the contention of Purtscher and Maggiore that there is rapid closure of the anterior part of the incision with minimal participation by the deeper structures. In the absence of a conjunctival flap, the anterior epithelial plug quickly formed and was well developed at the end of two days. The corneal stroma showed very little reaction except in the vicinity of the sutures where there was marked round cell infiltration. The proliferation of the corneal epithelium often extended along the track of the sutures. No posterior plug of fibrin was seen. Proliferation of the endothelium was negligible until five days

after the operation, at which time it often completely lined the posterior part of the incision.

Abnormal healing

Faulty closure of the wound occurs when the lips of the incision are not in proper apposition. This can take place either with or without tissue being included between the edges of the incision. Furthermore, such incarcerations may occur either at the time of operation or at a later date.

A. Healing with primary inclusion of tissue

Although primary inclusion of tissue, with its connotation of faulty toilet of the wound, is scrupulously guarded against, it still remains an important cause of delayed wound healing.

The nature of the tissue incarcerated determines to a large extent the type of repair that takes place. If a tag of conjunctiva is left between the lips of the wound, it may become expelled or completely absorbed and exert no pronounced effect upon healing. However, if the amount is sufficient to prevent approximation of the edges of the wound an epithelial cyst of the anterior chamber often does develop.

This fact has been demonstrated experimentally by Suzuki.[9] This investigator found that, following the implantation of conjunctiva into the anterior chamber, an epithelial cyst developed only in the presence of delayed wound healing. Clinically this observation has been confirmed by several authorities.[10-12]

While the presence of lens matter in a wound incites a marked reaction in the surrounding tissues, if the retained substance is only capsule it may cause little or no inflammation. The reaction created by incarcerated cortical matter usually produces a firm cicatrix. On the other hand, inclusion of only inert capsular material acts as an effective barrier to satisfactory closure of the wound.[1,2]

That the presence of capsule in the wound may lead to epithelial ingrowth has been pointed out by Henderson, Corrado,[13] and Terry, Chisholm, and Schonberg.[14]

Incarceration of formed vitreous causes a reaction very similar to that observed when cortical material remains in the wound. The vitreous is eventually absorbed and a firm scar is formed but the vitreous body always remains adherent to the inner surface of the wound. The pathologic processes occurring in this type of wound repair have been fully demonstrated by Collins, Parsons,[15] and Tooke. Fluid vitreous apparently exerts no such deleterious effect upon wound healing for, if accurate apposition is obtained, repair takes place in a normal manner. The effect of incarceration of iris will be considered in greater detail in the discussion on secondary inclusion of tissue.

B. Healing without inclusion of tissue

Faulty apposition of the edges of the incision does not invariably lead to incarceration of extraneous tissue for there are instances in which repair takes place without the benefit or hindrance of some intervening tissue. This type of repair often occurs when there is overlapping of the edges of the incision. In the absence of a flap, healing is then effected by a proliferation of the corneal epithelium as demonstrated by Henderson in 1907. If, however, such an overlapping takes place under a conjunctival flap the wound is closed by an overgrowth of highly vascularized episcleral tissue without inclusion of any intraocular tissue.

Healing without primary inclusion of tissue may also occur when there is faulty apposition of the cut surfaces either anteriorly or posteriorly. If the posterior edges of the wound are in good approximation but there is a gaping of the anterior layers of the wound, the reparative processes are similar to those seen in incisions where overlapping has occurred.

In the absence of a conjunctival flap the wound is closed by proliferation of the epithelial plug (fig. 1), whereas, when such a

separation of the anterior layers is covered by conjunctiva, the highly vascularized episcleral tissues play the dominant role in repair.[2]

If, on the other hand, the anterior edges are in good apposition but the deeper layers are separated, the mechanism of healing is

c. Healing with secondary inclusion of tissue

Secondary inclusion of tissue frequently follows the sudden rupture of any wound. This in turn often results in a frank prolapse of iris and/or vitreous.

The presence of iris tissue in a wound

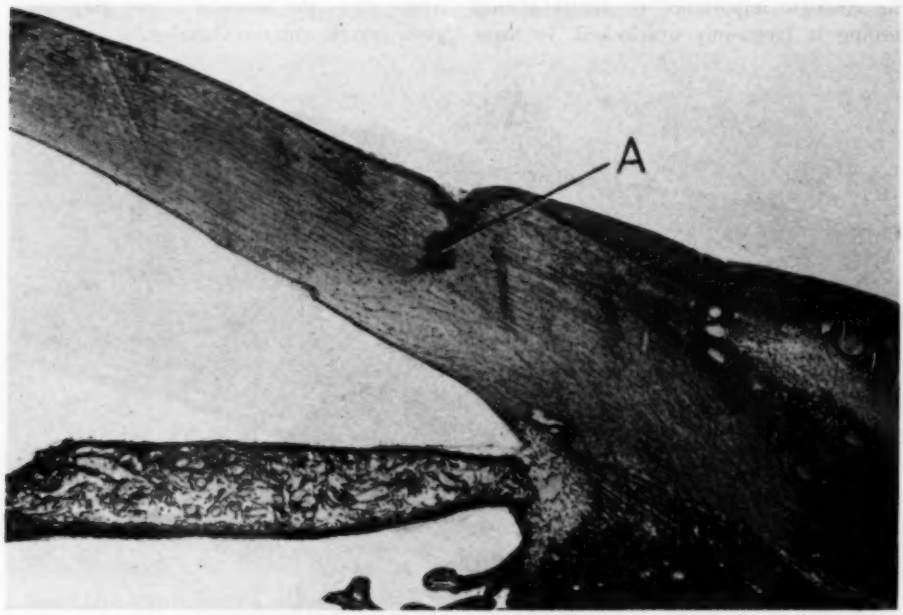

Fig. 1 (Dunnington). Eye of a monkey six days after operation, showing corneal section. (A) Anterior gaping filled with epithelial plug.

different. In the absence of a conjunctival flap, a minimal epithelial plug is formed and healing has to be effected by the corneal tissues themselves. This is a slow process brought about by increased swelling of the corneal lamellae and a gradual filling in of the defect with cells derived from the corneal substance.

If there is a conjunctival flap present, the anterior part of the wound is rapidly closed by proliferation of the episcleral tissues but, since the vascular plug is minimal, the closure is not firm until the corneal and scleral tissues have proliferated and closed the wound posteriorly (fig. 2).

usually leads to the development of a cystoid cicatrix but in some instances it causes an intense reaction in the surrounding structures with the eventual formation of a dense firm scar. According to Tooke, if a frank prolapse occurs, a firm scar is the expected result while, if the iris is only incarcerated, a cystoid cicatrix usually forms.

Dense cicatrization occurs more frequently if the prolapse takes place soon after operation when the healing processes are at their height. The gradual appearance of either a prolapse or an incarceration in the later stages of healing leads more often to the formation of a filtering cicatrix. That

trauma to the surrounding tissues plays an important role in the prevention of the formation of a cystoid scar is fully appreciated by those interested in the surgical treatment of glaucoma.

In contrast to the easily recognizable wound ruptures, there is another group in which the changes occur so insidiously that the etiologic importance of faulty wound healing is frequently overlooked. In these cases the defect in the wound is small, no definite rupture occurs but the clinical findings are those of wound leakage. The sequelae of these tiny dehiscences vary with the location of the wound. As pointed out by Vail[16] and by Theobald and Haas, epithelial downgrowth is the complication to be feared when such an opening occurs in any wound without a conjunctival flap.

The slowness with which corneal healing takes place and the relative weakness of the epithelial repair are factors common to all corneal incisions, irrespective of whether the gaping occurs anteriorly or posteriorly. In the presence of a conjunctival flap tiny wound ruptures cause different clinical pictures depending upon the site of the gaping.

If the deeper layers of the incision are in apposition but the anterior edges are separated, a large highly vascularized anterior plug is present. A small wound rupture under these conditions tends to lead to hemorrhage into the anterior chamber.[16,17] In extreme cases the vascular tissue may even grow into the anterior chamber.[2]

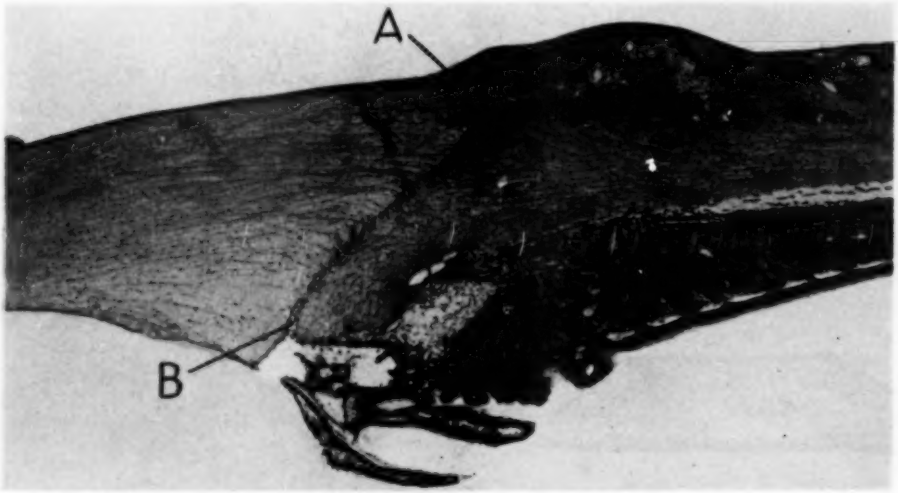

Fig. 2 (Dunnington). Eye of a monkey six days after operation, showing a limbal section. (A) Small fibrous plug. (B) Gaping posterior triangle lined with endothelium.

On the other hand, if in the presence of posterior gaping the anterior lips of the wound should become slightly separated, hemorrhage is usually not noted because of the small size of the anterior vascular plug. However, seepage of the aqueous humor does occur, the iris is often carried up into the wound, and a cystoid scar may develop.

In a clinical case of this sort the history is as follows: The operation and immediate postoperative convalescence were uneventful. The anterior chamber was reformed on the first dressing. In the cases where a peripheral iridectomy had been made the pupil was round. On or about the seventh

postoperative day the pupil was first noted to be slightly updrawn usually in the upper nasal quadrant. This remained more or less unchanged but within the next few weeks a tiny cystoid scar was noticed in this region. During all this time the visual acuity was normal and the eye comfortable.

These findings may persist indefinitely but often the patient returns complaining of episodes of blurred vision accompanied by excessive lacrimation. Although the cystoid scar may or may not appear larger, its epithelial covering has become thinner. The fluorescein test for leakage which usually is positive may be negative if used at a time when the conjunctival epithelium is intact.

Since these dehiscences are very tiny, the seepage of aqueous is not sufficient to cause loss of the anterior chamber nor does it occur rapidly enough to lead to detachment of the choroid. However, the epithelial covering does break, permitting aqueous to escape and hypotony to develop.

Nature often repairs the damage temporarily but, as the ocular tension rises, the epithelial covering gives way again and the whole process is repeated.

The detailed clinical picture of this condition has already been presented but since all the findings are the direct result of this type of imperfect wound healing attention is again directed to it.[18]

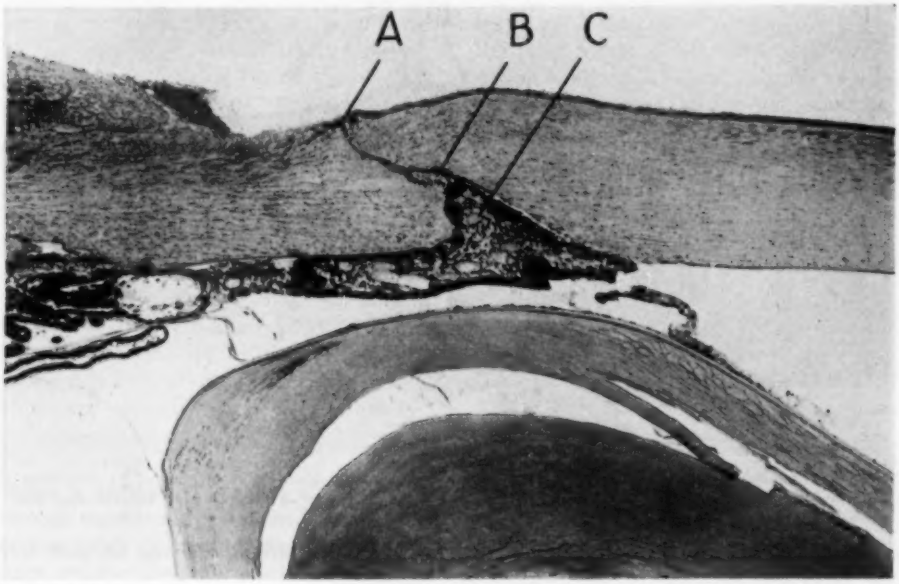

Fig. 3 (Dunnington). Eye of a monkey two days after operation, showing a corneal section. (A) Small anterior plug. (B) Posterior gaping. (C) Incarcerated iris.

Discussion

The practical application of these principles of wound healing will now be considered. They thoroughly establish the value of the routine use of a limbal incision with a conjunctival flap. The highly vascular nature of episcleral tissue causes prompt closure of the anterior part of the wound, while the conjunctival covering tends to prevent epithelium from growing between the edges of the incision.

Even more important is the knowledge that approximation of the deeper layers of

the wound is essential. Failure to have the posterior edges in contact may lead to posterior gaping which in turn predisposes to secondary inclusion of iris and the development of a cystoid cicatrix (fig. 3). It has been shown that tiny ruptures occasionally occur in these cystoid scars leading to delayed fistulization and epithelial downgrowth.

mating the posterior surfaces, may permit gaping of the anterior layers. If this occurs in the presence of a conjunctival flap, the vascular wedge of episcleral tissue is large and any separation of the posterior layers will be followed by bleeding into the anterior chamber. Both hemorrhage and loss of the anterior chamber are particularly prone to

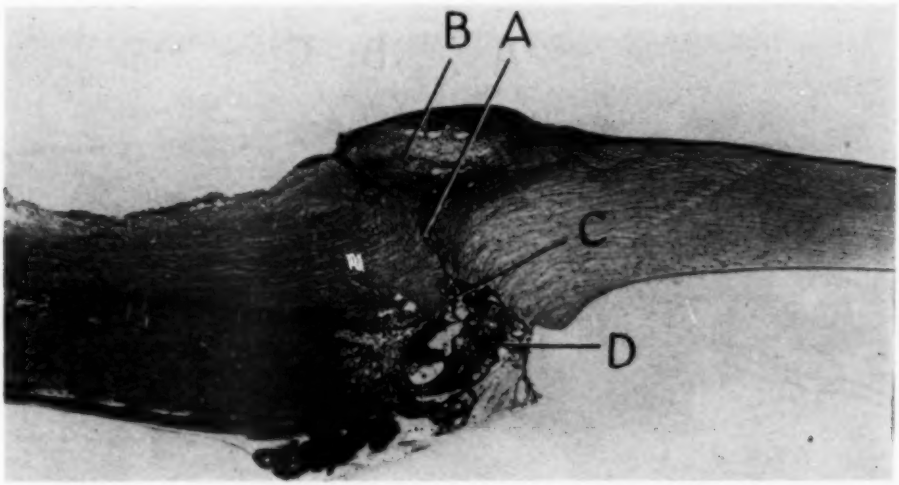

Fig. 4 (Dunnington). Eye of a monkey four days after operation, showing overriding. (A) Inversion of corneal lip of wound. (B) Large anterior fibrous plug. (C) Posterior gaping. (D) Incarcerated iris.

That such a complication may be produced by superficial suturing is substantiated by the following observation: In a recent analysis of 14 cases of delayed fistulization, the left eye was found to be the affected one in nine cases, and, in eight of these nine, the fistula was located in the upper nasal quadrant. This may be attributed to the mechanical difficulties encountered in correctly placing the scleral part of the suture in this portion of the wound.

If, in the absence of a conjunctival flap, a superficial suture is tied tightly it tends to cause gaping of the posterior surfaces. This in turn predisposes to spontaneous loss of the anterior chamber on or about the fifth day, with or without tissue incarceration. Deeply placed sutures, even though approxi-

occur at the time of removal of such deep sutures.

On the other hand, an absent anterior chamber often reforms promptly after taking them out. The presence of a flat anterior chamber one week or more after operation is, in my opinion, an indication for prompt removal of sutures because the track created by a penetrating suture may be used by the corneal epithelium to gain access to the interior of the eye.[14, 19]

According to the literature, when overriding is present, the corneal part of the section slides over the scleral edge. This doubtless does occur when no stuures are used, but the manner in which overlapping takes place seems to depend upon the location of the defect in suturing.

When the suture is too superficial on the corneal side, the sclera overrides the cornea (fig. 4). However, should the scleral bite be incorrectly placed the cornea does the overriding. Overlapping of the edges of the incision often results from failure to incorporate the scleral edge of the wound in the suture.

A splinting type of mattress suture, unless extremely accurately tied, often produces such an inversion of the scleral part of the incision. A similar result can follow the use of so-called appositional sutures if the scleral bite is placed a few millimeters away from the edge of the incision. If either of the two above-mentioned types of suture should be tied tightly, the chances of the scleral edge being rolled in are greatly increased.

In my hands faulty wound healing from this cause has been largely overcome by the use of border to border sutures. To insert a suture through the scleral edge of the incision is a delicate procedure but it can be accomplished if, with a small Elschnig type of forceps, the sclera is grasped parallel to the incision and then lifted slightly upward. The puckering produced by this maneuver makes it possible to pass a sharp needle through the scleral edge of the wound at the desired depth. It seems to me of no importance whether the suture is inserted before or after section so long as accurate approximation is obtained.

Realization that cataract incisions are not firmly united at the time of absorption of plain catgut sutures has deterred me from using them on a large scale. In several of my cases chromic catgut sutures have apparently caused severe reactions so I still prefer silk.

To obtain an even, smooth section some operators prefer to use a keratome for the original incision and to enlarge it with scissors while others, of whom I am one, still feel that a full section made with a Graefe knife is better. Since each method has certain advantages and disadvantages the instrument chosen is largely a matter of individual preference.

Although the selection will be influenced in no small part by the particular surgeon's training and experience, it is my belief that every ophthalmic surgeon should be familiar with both techniques and vary the choice according to existing conditions. In spite of every precaution, shelving of the cornea may take place when the original section is made with the keratome. In enlarging such an incision with scissors an uneven wound is frequently produced.

In an endeavor to encourage healing by primary intention, air is often injected into the anterior chamber at the conclusion of the operation. Its use is advocated to keep the iris and vitreous away from the wound during the time of primary agglutination. It is also felt that its presence aids in the approximation of the edges of the incision. This does occur in the majority of instances, but occasionally the reverse takes place.

The air gets behind the iris and remains there. This keeps the iris in contact with the wound so that even though the incision is tightly closed, an adhesion often develops. In my experience such broad anterior synechias have usually led to updrawn pupils and secondary glaucoma. If, on the other hand, there is even the slightest gaping of the posterior part of the wound an incarceration of iris occurs. This may lead to either a cystoid scar or a frank prolapse.

The routine use of air was employed for over two years, but these complications occurred with sufficient frequency to make me abandon this procedure.

I found that, when the pupil remained dilated upon the completion of the operation, the air was particularly prone to get behind the iris. This occurred in spite of the use of eserine salicylate (0.5 percent) just after delivery of the lens. Also, in several instances where a complete iridectomy had been done, the pillars of the iris became adherent to the wound.

In my hands the injection of air to restore an absent anterior chamber has been a disappointing procedure. In many instances the

air either escapes or is promptly absorbed and the original condition returns. I believe that a persistently absent anterior chamber can be best treated by resuturing the wound. For this repair I prefer to use a general anesthetic such as sodium pentothal.

In 1941, Gradle and Sugar,[20] in discussing wound rupture after cataract extraction, divided their cases into three groups: (1) Gaping with edema of the conjunctival flap; (2) rupture with tearing of newly formed vessels at the wound surfaces; (3) rupture with iris prolapse. This classification is closely similar to the one presented but our ideas of the causative factors differ. They attribute wound rupture to the rise in ocular tension produced by forcible contraction of the orbicularis palpebrarum and the extraocular muscles.

Vail[21] also thinks that separation of the wound occurs from an increased intraocular pressure which he believes is caused by an overproduction of aqueous humor. Granting that such an increase in ocular tension does occur and that it may precipitate wound leakage, I still feel that adequate closure is our best safeguard.

Judging from the studies made on the monkey, minor imperfections in wound closure are not infrequent. The most common ones are overlapping of the edges of the incision and gaping of the posterior lips of the wound. Closure of only the superficial layers seemed to be the cause of both of these conditions. The results of such suturing are shown in Figure 4. The superficially placed corneal suture has caused an inversion of the corneal edge leading to a large subconjunctival plug and gaping of the posterior lips of the wound. The iris has become adherent to the posterior part of the incision.

The importance of these minor imperfections in wound healing has been stressed because many of the complications commonly attributed to lack of coöperation by the patient are due to faulty closure of the incision. In my experience, hemorrhage into the anterior chamber is rarely traumatic in origin but usually develops spontaneously in cases in which deep sutures have been used in a scleral section. I also believe that delayed reformation of the anterior chamber or its subsequent loss is the direct result of improper suturing.

Summary

The reparative processes that take place in cataract incisions under both normal and abnormal conditions have been reviewed. It has been shown that certain differences exist in the healing mechanism of sections with and without a conjunctival flap. Since delayed wound healing is largely the result of improper apposition particular attention has been directed to the various types of faulty closure. The complications that frequently follow imperfect suturing have been pointed out.

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To Dr. Ellen F. Regan I extend my sincere thanks for her valuable assistance both in the experimental work and in the preparation of this manuscript.

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HERPES ZOSTER OPHTHALMICUS WITH BILATERAL HEMORRHAGIC RETINOPATHY*

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Los Angeles, California

This case is presented because of its rarity and because the retina offered an excellent site to observe minute details of the active pathologic process in the blood vessels.

In 1945, Edgerton[1] published an exhaustive review of the literature on herpes zoster ophthalmicus. He found that in 52 of 2,250 cases of herpes zoster with bilateral involvement there were a number with bilateral optic neuritis. Cases with additional complications of retinal hemorrhages, choroiditis, papillitis, retrobulbar neuritis, and optic atrophy were reported. Microscopic sections rarely demonstrated involvement of the posterior segment of the eye. However, there were reports of perineural infiltrates in the choroid. There were some which showed perivascular infiltrates unassociated with nerve fibers. The inflammation became primarily vascular rather than perivascular in some areas.

CASE REPORT

History. C. E. G., a 32-year-old man, was in good health until about June 12, 1948, when a persistent, severe pain developed above the right eye following exposure to chicken pox. Six days later vesicles broke out on the right side of his forehead, upper eyelid, and nose next to the inner canthus. The records of his private physician (June

* From the Ophthalmological Service, Wadsworth Hospital, Veterans Administration Center. Published with the permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the authors.

23) mentioned a small corneal ulcer near the limbus on the right eye at the 12-o'clock position. A weakness of the third nerve on the right side with diplopia was recorded July 6th. No pathologic condition of the fundus was seen. Double vision persisted until the left eye became blind. A cloudy vitreous and several small hemorrhagic areas in the retina of the left eye were reported on July 27th.

He was referred to another physician because a three-plus Kahn and one-plus Wassermann were found. The patient states he received about one million units of penicillin and 15 injections of an arsenical.

On October 8th, the posterior chamber of the left eye became so cloudy that it was impossible to see the fundus. The left eye became painful about November 20th. On November 30th, intraocular pressure was 70 mm. Hg (Schiøtz). Paracentesis was performed and reopened on five subsequent occasions.

He was first seen by us on December 9th, when admitted to the Veterans Administration Hospital, West Los Angeles, California.

Eye examination at the time of admission revealed numerous deeply pitted scars over the right forehead and portion of the nose next to the inner canthus. The patient did not distinguish the head from the point of the pin in this area.

There were approximately 15 prism diopters of exotropia for near. No vertical deviation was found, although precise evaluation was not possible as the left eye was blind. There were some dilated, tortuous bulbar conjunctival vessels in the left eye.

Tension was: O.D., 31 mm. Hg; O.S., 66 mm. Hg (Schiøtz). The 1.7/1,000 visual field for the right eye was entirely normal. There was slight constriction of the 3/330 field.

Right eye. The visual acuity of the right eye, uncorrected, was 20/20. Cornea and lens were clear. No evidence of inflammation was seen in the anterior chamber by slit-lamp examination. There were no keratic precipitates. There was a slight vitreous haze. The optic disc was normal in color. There was no edema or excess glial tissue about the disc. Sheathing of vessels was not found. The veins were not appreciably dilated. There was a network of venules coming off all the veins at the disc and forming many loops. Arteries did not appear involved. The peripheral arterioles were entirely normal. At the periphery of the retina and particularly in the superior temporal portion, the venules appeared irregularly constricted and dilated. Perivascular edema was thought to be causing this appearance although none was seen in several of the venules, definitely appearing to be small thrombi. There were numerous small, round, punctate, and mulberry-appearing hemorrhages throughout the periphery of the retina associated with the involved venules.

Left eye. The visual acuity of the left eye was only light perception and poor light projection. The corneal epithelium was edematous. Early blood staining of the cornea was seen. There was a 1 to 2 plus aqueous flare with a small hyphemia. No white keratic precipitates were visible. The pupil was regularly dilated without posterior synechias. Numerous large vessels coursed on the extreme anterior surface of the iris. Gonioscopy dimly revealed the pectinate ligament so that extension of the newly formed vessels into the angle could not be ascertained. A red reflex but no fundus details were seen because of the cloudy vitreous.

The general physical examination was essentially negative.

Genito-urinary consultants reported the prostate gland one half enlarged with many white blood cells by massage; 15 to 20 white blood cells were obtained on the subsequent massages. Ear, nose, and throat consultation reported hypertrophic, cryptic and chronically inflamed tonsils, bilaterally. Culture revealed nonhemolytic staphylococci, C. xerosis, hemophilus group, and N. catarrhalis. Tonsillectomy was performed on February 4, 1949.

The patient was referred to the Depart-

ment of Dermatology and Syphilology and after a most thorough examination was diagnosed as definitely nonsyphilitic. An intensive survey was carried out by the Department of Medicine. There were no significant findings.

Thorough laboratory studies were made. Blood work: CBC, normal; platelets, 350,000; bleeding time, three minutes; coagulation time, six minutes; coagulation time by Lee-White method, 15 minutes; capillary fragility, normal. Four blood cultures under aerobic and anaerobic conditions were negative. Three smears for malaria were negative.

Blood chemistry: serum bilirubin was 0.04 mg. percent; van den Bergh (indirect), 0.25 and 0.16 mg. percent; vitamin-A level, 169 gamma percent; prothrombin time, 17 seconds (17 seconds for control); cephalin flocculation, negative; total cholesterol, 307 mg. percent; esters, 242 mg. percent or 78 percent; uric acid, 6.6 mg. percent; total protein, 6.5; albumen, 5.0; globulin, 1.5; A/G ratio, 3.3; thymol turbidity, 0 units. Several glucose tolerance tests did not disclose diabetes mellitus.

Urinalysis: negative except an occasional white blood cell. Gram stain of second-glass urine, an occasional gram-negative rod.

Spinal fluid: cells, 5 lymphocytes; globulin, trace; total protein, 50 mg. percent; Wassermann, negative; gold curve, 0000000000.

Agglutinations; E. typhosa, 0-2 plus 1-40; E. typhosa, H-v 2 plus 1-960; Para A, 2 plus 1-20; Para B, negative.

Basal metabolism rate, plus five percent and minus one percent. Electrocardiograph, normal.

X rays: skull, normal; calcification in the pineal area; abdomen, splenic shadow not visualized; optic foramina, no enlargement; paranasal sinuses, normal; chest, small dense calcification in both hilar areas.

Skin tests: Trichinella, negative; p.p.d. #2, positive 3 plus; coccidiodin, 1-1,000, positive 1 plus; histoplasmin, 1-1,000, positive 3 plus.

The following diagnoses were established as most probable: (1) Herpes zoster ophthalmicus, right (2) hemorrhagic retinopathy, O.U., secondary to herpes zoster; (3) glaucoma, hemorrhagic, O.S.; (4) blindness (light perception) O.S.; (5) tonsillitis, mild (6) prostatis, chronic, mild.

Course. Between January 5 and 21, 1949, X-ray therapy (2,080 r (skin) Hvl., 0.51 cu. mm.) was given to the left eye to control pain. There was moderate relief. A cyclodiathermy operation was performed on February 15, 1949, which completely relieved the pain although the tension remained between 40 and 50 mm. Hg (Schiøtz).

A small hemorrhage from the newly formed blood vessels, extending into the vitreous from the right optic disc, occurred on February 8th and appeared to stimulate further proliferation of these delicate vessels.

It was possible that this vicious cycle might continue, so irradiation directed to the posterior segment was ordered. Dosage of 2,080 r (skin) Hvl., 0.51 cu. mm. were given between February 21st and March 10th without demonstrable damage to the lens, visual fields, or fundus. The visual acuity, O.D., was 20/15 with plus 0.75 D.sph. The only change noted was in the small new vessels about the optic disc. They were not observed to shrink and there appeared to be as many as before irradiation. However they were flattened down against the disc and retina instead of extending into the vitreous and did not appear as fragile.

Because of apparent improvement, an additional 1,400 r (skin) Hvl., 0.51 cu. mm. were given between March 25 and April 4, 1949. Tension remained normal as did visual fields and visual acuity. Between May 6 and 17, 1949, 1,600 r (skin) Hvl., 0.51 cu. mm. were added to the total dosage.

During this period of treatment, vitamins C and K, polyvitamin capsules, rutin, thromboplastin, and calcium gluconate were used. Pinhole discs were worn and the patient was placed on limited activity.

Examination on September 21, 1949,

showed a subhyaloid hemorrhage two disc diameters in diameter below the optic disc. There were still a few recent, small, punctate hemorrhages in the peripheral portion. There was some scarring and retinal atrophy in the superior temporal portion, with scattered pale mottled areas. Very little proliferation or migration of pigment was observed. Sheathing was not evident. Tension was 28 mm. Hg (Schiøtz); visual acuity was 20/20, uncorrected.

Discussion

The manifestations or herpes zoster are not always stereotype. Motor nerves may be attacked. The inflammation may involve the posterior roots and columns of the cord. While one ganglion is characteristically involved, adjacent ganglia may participate. A typical herpes zoster with neuralgia can occur without breaking out of vesicles.

Ocular complications may occur early or late. Ocular paralyses are said usually to occur about the time the skin eruption subsides. Scleritis usually occurs 2 to 3 months after the eruption and may be recurrent. Iridocyclitis may occur late, unassociated with keratitis, and run a chronic course.

Profound vascular changes occur in herpes zoster. In the skin, there may be perivascular infiltration, endothelial edema, hemorrhage, and necrosis with deep scarring. Hemorrhage into the anterior chamber is a prominent finding in primary zoster iritis. Numerous small hemorrhages, inflammatory cells, and necrosis are seen in the gasserian ganglion. Even the extraocular muscles may be involved. According to Duke-Elder,[2] "Wyss (1871) found pathologically numerous hemorrhages in the muscle substance and ascribed the muscular paralysis to thrombophlebitis and not to nerve causes."

Summary

A case of herpes zoster with bilateral hemorrhagic retinopathy is reported in detail. The retina offered an excellent site to observe minute details of the active process. Pinpoint thrombi were seen in venules near the equator while the arterioles appeared normal.

Veterans Administration Center,
Wilshire and Sawtelle Boulevards (25).

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OSTEOMA OF THE ORBIT

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A true osteoma of the orbit is of infrequent occurrence. The following case is reported because of the unusually large size of the tumor which resulted in a severe exophthalmos, with the danger of losing the eye from keratitis lagophthalmos. After the surgical removal of the growth, excellent cosmetic appearance and normal visual function were obtained.

Report of a case

History. Mr. G. M., aged 74 years, a white, retired barber, appeared for an examination on April 7, 1947. He complained of proptosis, pain, and lacrimation of the left eye. His family history and past personal history were noncontributory. In the early part of 1946, he became aware of a protrusion of his left eye, which gradually became worse but was never associated with any ocular or head pain, diplopia, or other generalized symptoms. There was no history of injury to the head. In the last week of March, 1947, the left eye became red and painful and lacrimated profusely; this was associated with a marked impairment of vision. At no time did he experience any difficulty with his right eye.

General examination. The patient was a well-nourished individual who presented a severe proptosis of his left eye and appeared to be in acute pain. His vision in the uninvolved eye was 20/30. The periorbital structures, lids, and lacrimal apparatus did not reveal anything unusual. The anterior ocular segment was normal. No intraocular pathologic condition was present and the fundus was negative. Perimetric studies showed no contractions or other abnormalities.

Vision in the left eye was 8/200. The eye presented an angry-looking proptosis and pointed downward and outward. It seemed to be frozen in the socket for there was practically no motion of any of the extraocular muscles. No bruit was audible and no abnormal pulsations were seen or palpable.

Transillumination did not produce any shadows. With the use of a plastic ruler held straight forward at the external canthal angle, the exophthalmos measured 29 mm.; that in the right eye measured 20 mm.

The lids were moderately swollen and a pronounced chemosis of the lower bulbar conjunctiva was present. The patient was unable to close the lids over the cornea and a keratitis lagophthalmos was present. Practically the entire cornea stained with one-percent fluorescein.

A large, firm, nodular mass was easily felt in the upper inner quadrant of the globe. It did not appear to be connected with the eyeball. There was an absence of any iritis or any lens changes. The media were grossly clear and, with the use of the giant ophthalmoloscope, it was possible to see a hyperemia of the disc, but there was an absence of any other findings of note.

The ocular tension to digital pressure did not seem to be elevated. It was not possible to improve the visual acuity of the involved eye by the usual methods of refraction.

Fig. 1 (Rizzuti). Appearance of patient on admission, April 7, 1947.

Homatropine hydrobromide (two percent) and penicillin ointment were placed in the eye and the patient was referrd to Dr. A. L. Loomis Bell for roentgenograms of the orbits. He reported the presence of a large, smooth, oval-shaped mass in the upper inner quadrant of the left orbit which seemed to originate from the lateral wall of the ethmoid sinus.

The mass had all the aspects of an eburnated osteoma. It measured about 4.0 cm. in length and 2.5 cm. in diameter. There did not appear to be any encroachment of the growth within the cranial cavity. The sella turcica was not eroded and there were no unusual findings of the optic foramen or canal. The sinuses were clear and no pathologic condition was visible in the right orbit. In view of the symptomatology and X-ray findings, the patient was advised to enter the hospital.

Course in hospital. On April 12, 1947, the patient was admitted to the Brooklyn Eye and Ear Hospital with the diagnosis of osteoma of the left orbit complicated by exophthalmos and keratitis lagophthalmos.

His temperature, pulse rate, and respiration were within normal limits. General physical examination which included neurologic studies failed to

Fig. 2 (Rizzuti). Anteroposterior view. Irregular ovoid osteoma apparently originating in the lateral ethmoid wall of the posterior ethmoid group of cells.

produce anything of unusual interest. Ear, nose, and throat examination was essentially negative except for a slight degree of sinusitis. He was made comfortable by the use of pontocaine ointment and the instillation of two-percent homatropine hydrobromide in the involved eye. He received a daily intramuscular injection of 300,000 units of penicillin in oil.

Laboratory studies. The Wassermann and Kahn reactions were negative. The blood count revealed 5,180,000 erythrocytes and 14,350 leukocytes with 72 percent polymorphonuclears, 4 percent monocytes, 20 percent lymphocytes, and 4 percent transitionals.

The hemoglobin was 100 percent and the color index, 0.9. The blood sugar was reported as 115 mg. per 100 cc. of blood.

Urinalysis did not show any sugar, albumin, casts, or formed cells. A culture of the left eye produced no bacterial growth. A smear revealed a few leukocytes and epithelial cells. The patient was

Fig. 3 (Rizzuti). Lateral view of osteoma, showing that it developed anteriorly.

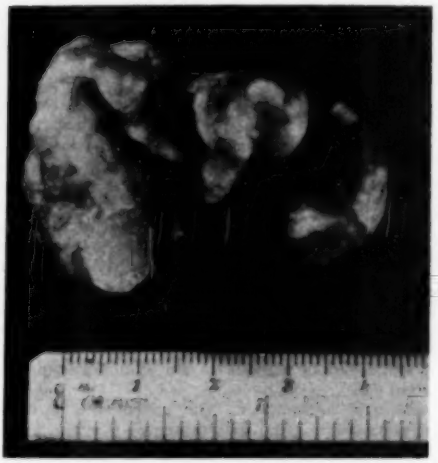

Fig. 4 (Rizzuti). Removed specimen, showing areas of fragmentation.

prepared for a general anesthesia and removal of the osteoma was performed.

Operative procedure. Dr. Robert Moorhead removed the osteoma through an anterior orbital approach. A nasofrontal incision was made similar to that used in performing a dacryocystorhinostomy. The periosteum was incised and reflected laterally with an elevator. The globe was carefully retracted and protected from the operative field.

A large bony tumor was encountered which occupied almost the entire ethmoid labyrinth. It was ivorylike in consistency and it was necessary to use an electric burr and chisel to fracture and dislocate the tumor.

The bony pieces were grasped with heavy Kelly forceps and rocked from side to side without producing any damage to the surrounding dura or cribriform plate. The dura appeared to be intact throughout. The bleeding was controlled with bonewax and adrenalin packs. The wound was closed with interrupted silk sutures and a gauze drain

was placed in its lower edge. The patient left the operating room in good condition.

Subsequent course. Dr. J. A. de Veer's pathologic report substantiated the diagnoses of osteoma. It was of the eburnated type and live bone cells were present.

The patient made an uneventful recovery and his wound healed by primary intention. He was discharged from the hospital on the 12th postoperative day with a fairly good cosmetic and functional result.

One month later there was almost a complete disappearance of the proptosis. The palpebral aperatures were of almost equal height and there was no ptosis or lagophthalmos. The extraocular muscles of the involved eye had resumed normal function. After refraction, his visual acuity improved to 20/20 in each eye.

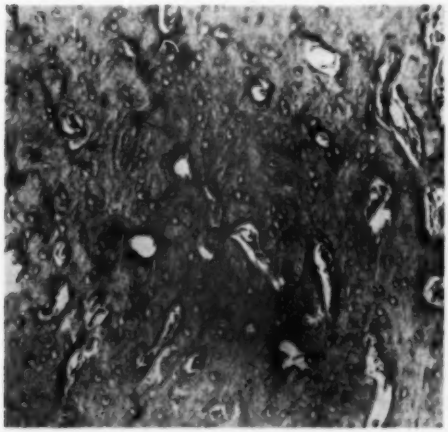

Fig. 5 (Rizzuti). A low-power view of the osteoma structure similar to that of dense regular bone.

The patient was kept under observation and on the date of his last visit on October 25, 1949, there was no recurrence of the orbital growth. There was an absence of any exophthalmos. The anterior ocular segments were free of any pathologic condition and the patient appeared to be in excellent health.

Comment

Osteoma of the orbit was first reported by Veiga in 1506. Up to the present, about 400 cases have been recorded in the literature. Reese,[1] in 1941, studied 109 cases of tumors arising primarily in the orbit and found osteoma in only one case. Forrest[2] reviewed

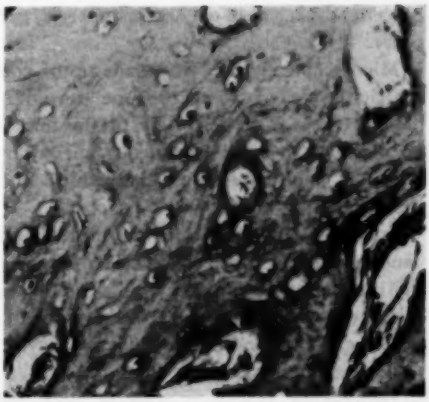

Fig. 6 (Rizzuti). A high-power view, showing live bone cells. Notice absence of blood elements.

184 primary orbital tumors which were collected from the Registry of Ophthalmic Pathology and osteoma existed in five cases.

An osteoma can spring from any part of the orbital wall but it is usually found in the upper inner angle. Osteomas are believed to originate from the lining of the paranasal sinuses or the periosteum. They are most commonly located in the frontal sinuses and next in the order of frequency follow the ethmoid, sphenoid, and maxillary sinuses. In 90 percent of the cases of those that originate in the frontal sinus there is a tendency to perforate the dura and enter the cranial cavity.

Parsons[3] divided them histologically into two main types: (1) Hard or eburnated (70

Fig. 7 (Rizzuti). Appearance of patient on October 25, 1949.

percent); (2) soft or cancellous (12 percent).

Microscopically they are made up of concentric layers of compact bone devoid of blood vessels. The periphery of the tumors is usually covered by mucous membrane which is continuous with that which lines the paranasal sinuses.

Small osteomas are of little clinical significance and are usually found accidentally during routine roentgenogram studies of the nasal sinuses. They grow very slowly over a period of years and as they enlarge they act as any expanding lesion of the orbit.

Because of this slow growth, pain and diplopia are not outstanding features. In time, however, the exophthalmos may become very pronounced and keratitis lagophthalmos may result due to inability to close the lids. Pain, conjunctival reaction, and inflammatory changes may then assume primary importance.

If the osteoma reaches sufficient size, perforation of the dura can ensue and the tumor may enter the cranial cavity. If secondary infection sets in, brain abscess or meningitis may follow.

Baker[4] has demonstrated that air may also enter the brain cavity producing hemiplegia and choked discs.

Cushing[5] has shown that osteoma which involves the frontal and ethmoid sinuses may result in bizarre neurologic syndromes. He reported four patients in which there was penetration of the dura; two of them died from secondary brain complications.

The tumor is histologically benign but, if it assumes sufficient size, it may take on malignant clinical characteristics.

The surgical removal of osteoma is accomplished by means of several approaches, mainly: (1) Through the nares; (2) through the orbit—by a cutaneous or conjunctival incision; (3) through the cranium.

When the tumors are small and easily accessible they can be removed through the nose. This procedure, however, is not universally recommended.

Benedict[6] stresses that the most practical route is that through the orbit by means of a skin or conjunctival incision located as close as possible over the area of the growth. If the dura has been perforated and the patient presents neurologic complications, Cushing then recommends a cranial approach by the use of a frontal osteoplastic craniotomy.

Summary

A case of osteoma of the orbit is reported. The salient features which the case illustrates are:

1. That the osteoma can assume large proportions before producing any acute eye symptoms.
2. That the diagnosis is readily established by roentgenographic studies.
3. That the most practical surgical approach is through the anterior orbital route.

A plea is made for early surgical intervention to offset any late complications and sequelae.

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CYCLOELECTROLYSIS FOR GLAUCOMA*

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The subject of cycloelectrolysis (cyclocatholysis) for the reduction of intraocular pressure in various types of glaucoma is presented for several reasons: (1) Because of the great importance of any operation which may partially or completely control tension, especially in patients with intractable glaucoma, (2) encouraging results obtained in 65 eyes of 61 patients critically analyzed for a period of six months to four years, (3) to discuss the electrochemical effects of the new operative procedure on the ciliary body and processes, (4) to evaluate the possible advantages of this operation in preference to cyclodiathermy (penetrating and nonpenetrating) from both theoretical and clinical standpoints, (5) to describe the indications, contraindications, and technique of the operation, (6) to evaluate briefly the results obtained in the patients subjected to this procedure and to refer to some findings in animal experiments,† (7) because no description of the use of cycloelectrolysis for the control of tension in glaucoma has been found in the literature by us or the library of the American College of Surgeons.

The concept of applying galvanic current to the ciliary body arose from a study by one of us (C. B.) of its effect in retinal detachment operations.[1] Galvanic current was first applied to the retina by H. Schoeler,[2] in 1889, but the application of this method to the ciliary body as a treatment for glaucoma by inducing localized atrophy of the tissues by chemical action was first used by one of us (C. B.) in 1945. The procedure has been twice referred to briefly.[3,4]

Cycloelectrolysis is a new operative technique devised for the purpose of reducing intraocular pressure in various types of glaucoma and differs from perforating cyclodiathermy primarily in the type of current employed to produce an atrophy of part of the ciliary body.

In cycloectrolysis there is a controlled chemical decomposition of tissue which is produced by means of galvanic current. In cyclodiathermy (penetrating and nonpenetrating) a high frequency current of more than a million oscillations per second is employed. The needle or ball electrode remains cold but the resistance of the tissues to the passage of current through them generates enough heat to cause an instantaneous coagulation of the protein present. A high frequency current produces no chemical (electrolytic) changes in the tissues. In cyclodiathermy the surface tissue is dehydrated and shrunken and some sparking of tissue may occur, with subsequent undesirable carbonization.

In cycloelectrolysis the amperage determines the amount of chemical tissue destruction in the ciliary body in a specified time, whereas in cyclodiathermy the amperage indicates only the current passing through the ciliary body and cannot be used

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† A complete report of the experiments on rabbits and the pathologic findings in human and rabbit eyes is in preparation.

as a measure of the amount of tissue destruction, since the resistance of the tissues is a variable factor in each case. The essential difference between the two procedures accounts for the apparently greater effectiveness of cycloelectrolysis in the control of intraocular pressure, the lessened congestion of the ciliary body and eyeball, as well as the minimal amount of destruction and contraction of the sclera observed after cycloelectrolysis as compared with cyclodiathermy.

It has been pointed out by Vogt,[5] Wagner,[6] and Stocker[7] that there is an immediate postoperative rise of intraocular pressure in nonperforating cyclodiathermy due to a puckering of the sclera, with reduction in the size of the globe. This elevation in tension is also increased by the application of cyclodiathermy through congestion and shrinking of the eyeball. There is less marked increase of intraocular pressure following cycloelectrolysis since there is only a mild reaction in the tissues and insignificant shrinking of the eyeball.

Many of the objections stressed by surgeons[8,9] who prefer nonperforating to perforating diathermy are overcome, and some of the complications noted following nonperforating diathermy are eliminated.

Several patients have developed sympathetic ophthalmitis following cyclodiathermy when no sympathetic ophthalmitis has so far followed cycloelectrolysis. Chemical destruction versus heat destruction may account for the difference if it can be proved to be statistically significant. Trichloracetic acid applied to a prolapsed iris seems to be less dangerous than heat cauterization of the uveal tissue.

In cycloelectrolysis, the negative pole of a galvanic current attached to a fine needle is used as the "active" electrode, and the positive pole or "dispersive" electrode is placed beneath the patient's shoulder. When the current is applied and the needle penetrates the ciliary body, the sodium chloride, present in solution in all body tissues, is ionized. The sodium ion migrates to the cathode, is neutralized, then reacts with water to form sodium hydroxide with a release of hydrogen. Sodium hydroxide is a strong caustic agent which causes a chemical liquefaction of the cells around the needle. By regulating the amperage and the duration of the application, the amount of tissue dissolution may be controlled accurately.

We have elected to use the negative pole as the active electrode on human eyes since we found in animal experiments that when the positive pole of the galvanic current was connected to the needle, the tissues became hardened through the action of the hydrochloric acid formed and adhered to the needle. There was also more damage to the sclera, increasing the possibility of herniation of the ciliary body.

There are two main mechanisms to be considered in the maintenance of normal intraocular pressure: (1) The production of fluids, generally considered to be a function of the ciliary body and its processes and (2) an adequate drainage system.

Cycloelectrolysis is a procedure designed to reduce the production of aqueous by a chemical destruction and subsequent atrophy of a part of the ciliary body and its processes with the least possible trauma and a minimum of complications.

In a subsequent paper, we propose to present data concerning the value of cycloelectrolysis compared with both perforating and nonperforating cyclodiathermy which also are operations designed to diminish the production of aqueous.

Indications for cycloelectrolysis

1. Chronic primary glaucoma (21 cases are reported in Table 1).

a. Chronic primary glaucoma, especially in Negroes. It is a well-established fact that the Negro tends to have excessive keloid formation and consequently does not usually respond favorably to filtering operations.

Because cycloelectrolysis causes so little reaction and discomfort to the patient, it

may be advisable, when we have gained more experience, to consider cycloelectrolysis more frequently as a primary procedure in whites as well as in Negroes.

2. Glaucoma in aphakia (nine cases are reported in Table 1.)

a. Cyclodialysis has been the operation of choice heretofore because of the limited application of filtration operations. Cycloelectrolysis must be considered a valuable procedure in this type of glaucoma.

3. Cycloelectrolysis is especially indicated in narrow-angle types of glaucoma.

4. Absolute glaucoma (seven cases are reported in Table 1).

a. Cycloelectrolysis has been proved to be of great value in those cases of absolute glaucoma with intractable pain, and this procedure may be recommended in some cases in preference to enucleation.

5. Uveitis with secondary glaucoma (four eyes reported in Table 1).

a. The comparative freedom from reaction has encouraged us to try cycloelectrolysis in uveitis with uncontrolled pressure. Case 62 was operated upon for glaucoma secondary to uveitis in sarcoidosis.

6. Other forms of glaucoma. Cycloelectrolysis may prove of benefit in the following types of glaucoma:

a. Central venous thrombosis (three cases)

b. Hydrophthalmos and buphthalmos (five eyes)

c. Rubeosis of the iris (four cases)

d. Hemorrhagic glaucoma (five cases)

e. Acute glaucoma (five cases)

f. Secondary glaucoma resulting from trauma (three cases)

Contraindications for cycloelectrolysis

1. Intraocular tumor. It is obvious that every precaution should be taken to rule out any possibility of an intraocular tumor before attempting cycloelectrolysis.

2. Glaucoma capsulare.

3. Lens dislocated into the anterior chamber.

Operative procedure

Preoperative preparation

1. Preoperative sedation of nembutal (three gr.) is given one hour before operation.

2. Tonometer readings are made before and after surgery.

Anesthesia

1. Topical anesthesia is obtained by instillation of pontocaine (one percent).

2. Retrobulbar injection (1.0 cc. of 2.0 percent procaine with three minims of epinephrine hydrochloride (1:1,000) into the ciliary ganglion.

Apparatus required

A galvanic machine with a potential of at least 22.5 volts and a milliampere scale sufficiently large to show small variations between 0 and 10 milliamperes.

The positive pole or dispersive electrode is placed somewhere on the patient's skin, using an electrolytic jelly to insure a good contact. The negative pole or active electrode is a specially designed platinum straight conical electrolysis needle* (Berens) measuring 1.5 or 2 mm. in length, and 0.18 mm. in diameter.

We have found in our animal experiments that a needle which is long enough to penetrate the ciliary body causes exudation at the site of the puncture.

The setting of the rheostat is determined by applying the needle to the conjunctiva and adjusting the rheostat so that the milliammeter registers five ma. Experience has indicated that five ma. for five seconds gives an optimum amount of destruction in the ciliary body with minimum ocular reaction.

Technique

The eyeball is immobilized with a bipronged scleral hook.

* Made by Mueller & Co., Chicago, Illinois.

TABLE 1

CYCLOELECTROLYSIS FOR GLAUCOMA

Chronic Simple Glaucoma—21 Cases, 23 Eyes

Cases	*Diagnosis*	*Preoperative Vision and Tension (Schiötz)*	*Previous Operations—Postoperative Vision and Tension (Schiötz)*
1. J. W., aged 52, female, white	Chronic simple, wide angle O.D. Slight cupping O.D.	V. O.D. 4/200 sc. 20/200 cc. T. O.D. 35	10/48 Iridocorneosclerectomy O.D. V. 20/200 T. 48 10/48 Posterior Sclerectomy O.D. V. 20/100 T. 50
2. F. C., aged 75, female, white	Chronic simple Nuclear sclerosis Aphakia O.D. Endophthalmitis	V. O.D. 20/70 sc. and cc. T. O.D. 34	9/48 Iridocorneosclerectomy and Tenon's capsule transplant O.D. V. H.M. T. 22 11/48 Cataract extraction O.D. T. 45
3. S. A., aged 58, male, white	Chronic simple, wide angle O.S.	V. O.S. 4/500 cc. T. O.S. 40	4/44 Iridocorneosclerectomy and incarceration O.S. 12/44 Intracapsular extraction and iridocorneosclerectomy O.S. O.S. V. H.M. T. 50
4. E. S., aged 62, female, white	Chronic simple O.S. Onset 6 yrs. Shallow A.C.	V. O.S. 5/200 cc. T. O.S. 47	4/42 Cyclodialysis O.S. 10/42 Cyclodialysis O.S. O.S. V. L.P. T. 29
5. C. M., aged 49, female, white	Chronic simple O.D. Onset 3 yrs. Normal A.C. Aphakia	V. O.D. 20/20 cc. T. O.D. 49	None
6. S. H., aged 72, male, white	Chronic simple O.S. Onset 2 yrs. Shallow A.C.	V. O.S. 20/50 cc. T. O.S. 48	None
7. M. B., aged 40, female, white	Chronic simple O.D. Onset 7 yrs. Shallow A.C.	V. O.D. N.L.P. T. O.D. 50	Had 1 operation O.D. previously No light perception O.D. Severe pain
8. N. E., aged 74, male, white	Chronic simple O.D. Onset 4 yrs. Marked uveitis Cupping O.D.	V. O.D. H.M. T. O.D. 47	5/47 Iridencleisis O.D. Complete subluxation lens O.D.
9. A. S., aged 64, male, white	Chronic simple O.D. Onset 3 yrs. Marked cupping Shallow A.C.	V. O.D. L.P. T. O.D. 90	None
10. O. V., aged 52, female, white	Chronic simple O.S. Onset 2 yrs. Slight cupping Normal A.C.	V. O.S. 20/200 cc. T. O.S. 90	3/47 Iridocorneosclerectomy O.S. V. O.S. 20/200 T. 45
11. R. L., aged 68, male, white	Chronic simple O.D. Onset 6 mos. Disc and A.C. normal	V. O.D. 20/200 cc. T. O.D. 90	None
12. H. R., aged 70, female, white	Chronic simple O.S. Onset 1 yr. Cupping, atrophy, shallow A.C. Pinhole pupil O.U.	V. O.S. 20/30 cc. T. O.S. 42	4/37 Trephine O.S. 11/42 Combined intracapsular extraction O.S. T. 45 V. F. 3′
13. T. G., aged 49, male, white	Chronic simple O.D. Onset 3 mos. Advanced cupping Normal A.C.	V. O.D. 20/100 T. O.D. 65	4/47 Iridocorneosclerectomy O.D. T. 20–50 10/47 Paracentesis O.D. T. 40
14. P. B., aged 58, male, white	Chronic simple O.D. Onset 13 mos. Slight cupping Normal A.C.	V. O.D. 20/30 cc. T. O.D. 40	None
15. L. B., aged 59, male, white	Chronic simple O.D. Onset 10 yrs. Slight cupping Normal A.C.	V. O.D. 20/50 cc. T. O.D. 47	None
16. A. D., aged 49, male, white	Chronic simple O.D. Onset 4 yrs. Slight cupping Normal A.C.	V. O.D. L.P. T. O.D. 90	3/48 Iridectomy O.D. T. 90
17. H. R., aged 41, male, Negro	Chronic simple O.U. Onset 3 days Normal disc Shallow A.C. O.U.	V. O.D. 20/40–1 sc. O.S. 20/30–2 sc. T. O.D. 48–65 O.S. 30–45	None
18. G. H., aged 41, female, Negro	Chronic simple O.S. Onset 1 yr. Shallow A.C. Disc normal	V. O.S. 20/20 cc. T. O.S. 45	3/45 Iridocorneosclerectomy O.S. V. 20/50 T. 40

Cycloelectrolysis	*Additional Surgery*	*Postoperative Vision and Tension (Schiötz)*	*Visual Fields and Remarks*
12/48 Cycloelectrolysis O.D.—50 punctures 5 ma. 5 sec. T. 40	12/48 Iridocorneosclerectomy O.D.	5/49 V. O.D. 20/200 T. O.D. 20	Preoperative gunbarrel field unchanged. Tension controlled 5 mos. Vision improved. Miotics continued.
11/48 Cycloelectrolysis O.D.—50 punctures 5 ma. 5 sec. T. 34–47	2/49 Cyclodialysis and aspiration A.C. O.D.	5/49 V. O.D. 20/60 T. O.D. 24	Postoperative visual fields unchanged. Vision improved. Tension controlled with miotics.
6/45 Cycloelectrolysis and superficial keratectomy O.S.—48 punctures	None	3/49 V. O.S. H.M. T. O.S. 19	Tension controlled 4 yrs. without miotics. Full fields with light unchanged.
6/45 Cycloelectrolysis O.S.—48 punctures 5 ma. 5 sec.	1/46 Superficial keratectomy O.S.	3/49 V. O.S. L.P. T. O.S. 17	Tension controlled 4 yrs. without miotics. Slight field loss with light.
5/48 Cycloelectrolysis O.D.—50 punctures 5 ma. 5 sec.	None	5/49 V. O.D. 20/40 T. O.D. 20	Tension controlled 1 yr. with miotics. Preoperative concentric contraction unchanged.
3/48 Cycloelectrolysis and paracentesis O.S.—50 punctures 5 ma. 5 sec.	10/48 Cyclodialysis O.S.	1/49 V. O.S. 3/200 T. O.S. 50	No improvement.
3/48 Cycloelectrolysis O.D.—30 punctures 5 ma. 5 sec.	None	5/49 V. N L.P. O.D. T. O.D. 18	Tension controlled 14 mos. without miotics. No pain.
5/48 Cycloelectrolysis O.D.—32 punctures 5 ma. 5 sec.	None	3/49 V. O.D. L.P. T. O.D. 22	Tension controlled with miotics. No pain. Vision same. No fields.
5/48 Cycloelectrolysis O.D.—50 punctures. Upper half 5 ma. 5 sec.	None	5/49 V. O.D. L.P. T. O.D. 20	Tension controlled 12 mos. without miotics. No pain. Vision same; no fields.
5/47 Cycloelectrolysis O.S.—50 punctures. Lower half 5 ma. 5 sec.	None	5/49 V. O.S. 20/200 T. O.S. 20	Tension controlled 2 yrs. without miotics. Preoperative concentric contraction field with light unchanged postoperatively.
10/48 Cycloelectrolysis O.D.—50 punctures. Upper half 5 ma. 5 sec.	None	5/49 V. O.D. 20/30 T. O.D. 20	Tension controlled 7 mos. without miotics. Vision improved. No change in visual fields.
11/48 Cycloelectrolysis O.S.—50 punctures 5 ma. 5 sec.	None	5/49 V. O.S. 20/50 T. O.S. 20	Tension controlled 6 mos. without miotics. Vision improved. No change in visual fields.
11/47 Cycloelectrolysis O.D.—50 punctures 5 ma. 5 sec. T. O.D. 32–40	11/47 Trephine and iridencleisis O.D.	3/49 V. O.D. 20/40 T. O.D. 20	Tension controlled 15 mos. with miotics. Vision improved. No fields.
3/48 Cycloelectrolysis O.D.—50 punctures with paracentesis 5 ma. 5 sec.	None	3/49 V. O.D. 20/50 cc. T. O.D. 20	Tension controlled 12 mos. with miotics. Slight contraction visual fields.
4/48 Cycloelectrolysis O.D.—38 punctures 5 ma. 5 sec. O.D. T. 50	6/48 Trephine O.D.	3/49 V. O.D. L.P. T. O.D. 30	Tension lowered. Complicated cataract O.D. No fields.
3/48 Cycloelectrolysis and iris inclusion O.D. T. 10	Enucleation O.D.		Eye becomes soft and dangerous—removed.
1/47 Cycloelectrolysis O.D. 36 punctures. T. 20–50 2/48 Cycloelectrolysis O.D. 32 punctures. 5 ma. 5 sec. 4/48 Cycloelectrolysis O.S. 50 punctures. 5 ma. 5 sec.	None	3/49 V. O.D. 20/20 sc. O.S. 20/20 sc. T. O.D. 20 O.S. 20	Tension controlled O.D. 13 mos. O.S. 11 mos. without miotics. Vision and visual fields improved O.U.
3/48 Cycloelectrolysis and aspiration A.C. O.S.	None	3/49 V. O.S. 20/30 cc. T. O.S. 20	Tension controlled 1 yr. without miotics. Slight contraction fields.

TABLE 1—*Continued*

19. H. K., aged 43, female, Negro	Chronic simple O.U. Onset 2 yrs. Cupping and atrophy Shallow A.C. O.U.	V. O.D. 20/50 cc. O.S. 20/70 cc. T. O.D. 40 O.S. 48	3/47 Perforating cyclodiathermy O.D. V. 20/70 T. 65
20. A. D., aged 52, female, Negro	Chronic simple O.S. Onset 3 yrs.	V. O.S. 20/40 cc. T. O.S. 23	7/38 Iridocorneosclerectomy O.S. T. 50 4/40 Trephine O.S. T. 40 12/48 Aspiration A.C. T. 32
21. L. W., aged 45, male, Negro	Chronic simple O.D. Onset 9 mos. Marked cupping O.D.	V. O.D. 20/50 cc. T. O.D. 70	4/47 Iris inclusion operation O.D.
Secondary Glaucoma Following Cataract Extraction—9 Eyes			
22. H. B., aged 60, male, white	Immature cataract Thrombosis central vein O.D.	V. O.D. 20/200cc.	6/43 Combined extraction O.D. 6/47 V. O.D. F. 1' T. O.D. 65
23. A. W., aged 63, male, white	Postcapsular cataract O.S.	V. O.S. 20/70 cc.	4/43 Optical iridectomy O.S. 6/43 Extracapsular extraction O.S. 8/43 V. O.S. 5/100 T. 43 10/43 Cyclodiathermy O.S. T. 30 1/44 Iris inclusion O.S. T. 40 3/44 Discission O.S. V. 20/40 T. 40
24. B. G., aged 62, male, white	Immature senile cataract O.D.	V. O.D. 20/70 cc.	3/44 Combined intracapsular extraction O.D. T. 40 4/44 Iridencleisis O.D. 6/44 Cyclodiathermy O.D. T. 40 2/45 Iridectomy O.D. T. 55–65
25. A. B., aged 65, male, white	Immature cataract Secondary iritis Aphakia O.S.	V. O.S. 3/200 cc.	4/47 Preliminary iridectomy O.S. 9/47 X.A.P. O.S. T. 47–58 9/47 Cyclodialysis O.S.
26. F. I., aged 6, male, white	Immature cataract O.S.	V. O.S. 20/200 cc.	5/47 Cataract extraction O.S. T. 90 8/47 Iridocapsulotomy O.S. T. 38 10/47 Cyclodialysis O.S. T. 60 11/47 Paracentesis O.S. T. 50
27. R. F., aged 57, female, white	Incipient cataract O.S.	V. O.S. 20/200 cc.	2/42 Extra-intracapsular extraction O.S. T. 16–60 V. 20/20 cc. 5/44 Shallow A.C. cupping and atrophy Cyclodialysis and iridectomy O.S. V. O.S. 4/100 T. 65
28. S. G., aged 74, male, white	Hypermature cataract O.D.	V. O.D. L.P.	1/47 Combined extracapsular extraction O.D. V. 20/40 T. 33–40
29. F. W., aged 68, male, white	Postcortical cataract-sclerosis O.U.	V. O.S. 20/200 T. O.S. 17	6/48 Intracapsular extraction and peripheral iridectomy O.S. T. 60
30. V. M., aged 73, male, white	Mature cataract O.D.	V. O.D. H.M.	6/47 Cataract extraction O.D. V. H.M. T. 40 Shallow anterior chamber
Secondary Glaucoma following Trauma—3 Eyes			
31. H. S., aged 68, male, white	Struck in O.D. Dislocated lens and secondary glaucoma	V. O.D. F.1' T. O.D. 48	9/47 Cataract extraction O.D.
32. J. S., aged 50, male, white	Sulphuric acid burn. Secondary glaucoma O.S.	V. O.S. 20/100 T. O.S. 70–75	5/45 Keratectomy and peridectomy O.S. 6/45 Cataract extraction O.S. T. 72
33. M. C., aged 45, male, white	Alkali burns. Keratitis-secondary glaucoma O.S.	V. O.S. N.L.P. T. O.S. 22	7/48 Radium treatment; conjunctival flap over perforating wound O.S.
Secondary Glaucoma Associated with Uveitis—4 Eyes			
34. B. I., aged 34, female, white	Mature cataract O.S. Myopia. Choroidal atrophy, aphakia, secondary glaucoma, uveitis O.S.	V. O.S. 20/100 T. O.S. 48	3/48 Combined extracapsular extraction O.S. V. 20/100 T. 48 5/48 Cyclodialysis O.S. T. 35

3/47 Cycloelectrolysis O.S. 32 punctures 9/47 Cycloelectrolysis O.D. 32 punctures	12/47 Trephine O.D. 2/48 Iridencleisis and sclerectomy O.D. 4/48 Cycloelectrolysis. 50 punctures O.D.	5/49 V. O.D. 20/30 cc. O.S. 20/30 cc. T. O.D. 20 O.S. 22	Tension controlled 2 yrs. O.S. without miotics; cycloelectrolysis done as primary procedure. Preoperative gunbarrel fields unchanged postoperatively O.U.
2/49 Cycloelectrolysis O.S. 30 punctures 5 ma. 5 sec.	None	5/49 V. O.S. 20/70 cc. T. O.S. 22	Pain relieved. Case requires further observation.
5/48 Cycloelectrolysis O.S. 50 punctures 5 ma. 5 sec.	None	5/49 V. O.S. 20/70 T. O.S. 20	Tension controlled 1 yr. without miotics.

8/48 Cycloelectrolysis O.D. 42 punctures 5 ma. 5 sec.	None	3/49 V. O.D. H.M. T. O.D. 40	Tension lowered. Miotics continued. Vision decreased O.D. No fields.
11/48 Cycloelectrolysis O.S. 30 punctures 5 ma. 5 sec.	None	3/49 V. O.S. 20/40 cc. T. O.S. 30	Tension lowered; miotics continued. Vision improved. Small central field retained postoperatively.
12/47 Cycloelectrolysis 32 punctures O.D. T. 55	2/48 Trephine O.D.	3/49 V. O.D. H.M. T. O.D. 50	No improvement.
10/47 Cycloelectrolysis and aspiration A.C. O.S. 38 punctures 5 ma. 5 sec.	None	5/49 V. O.S. 20/30 cc. T. O.S. 18	Tension controlled without miotics 19 mos. O.S. Visual fields unchanged postoperatively.
11/47 Cycloelectrolysis O.S. 32 punctures 5 ma. 5 sec.	None	3/49 V. O.S. 20/100 cc. T. O.S. 50	No improvement in tension.
2/48 Cycloelectrolysis O.S. 40 punctures 5 ma. 5 sec.	3/48 Enucleation O.S.		Eye became hypotonic.
2/48 Cycloelectrolysis O.D. 40 punctures 5 ma. 5 sec.	None	3/49 V. O.D. H.M. T. O.D. 20	Tension controlled 13 mos. without miotics O.D.
7/48 Cycloelectrolysis O.S. 50 punctures 5 ma. 5 sec.	7/48 Cyclodialysis O.S. T. 65 8/48 Aspiration (3 times) O.S. 8/48 Cyclodialysis. 9/49 Iridocorneosclerectomy O.S. 10/48 Cyclodiathermy. Evisceration		Retina detached following cyclodiathermy. Iris was completely adherent to vitreous. Eye became dangerously soft. Eviscerated 12/48 O.S.
11/47 Cycloelectrolysis O.D. 32 punctures 5 ma. 5 sec.	None	5/49 V. O.D. F. 2' T. O.D. 20	Tension controlled O.D. 18 mos. without miotics. Slight improvement vision.

1/48 Cycloelectrolysis O.D. 36 punctures 5 ma. 5 sec.	None	5/49 V. O.D. 20/70 T. O.D. 17	Tension controlled O.D. 16 mos. without miotics. Vision improved.
7/45 Cycloelectrolysis O.S. 40 punctures 5 ma. 5 sec.	None	3/49 V. O.S. 20/100 T. O.S. 30	Tension controlled O.S. 3½ yrs. with miotics. Vision same.
12/48 Cycloelectrolysis and electroparacentesis O.S. 35 punctures	Beta irradiation continued	1/49 V. O.S. N.L.P. T. O.S. 12	Tension controlled without miotics.

6/48 Cycloelectrolysis O.S. 50 punctures 5 ma. 5 sec.	12/48 Iridocorneosclerectomy O.S.	3/49 V. O.S. 20/100 T. O.S. 25	Tension controlled with miotics. Postoperative fields unchanged.

TABLE 1—*Continued*

35. J. G., aged 74, male, white	Secondary glaucoma, uveitis O.S. Bullous keratitis. Edema K.P Shallow A.C.	V. O.S. L.P. Temporal side only T. 65	Had cataract extraction 20 yrs. ago O.S. 10/31 Ant. sclerotomy O.S. 4/34 Ant. sclerotomy O.S. 5/43 Cyclodiathermy O.S.
36. A. E., aged 45, female, white	Secondary glaucoma. Uveitis O.U.	V. O.D. L.P. O.S. H.M. T. O.D. 60–65 O.S. 40	None
Secondary Glaucoma (Miscellaneous) 4 Eyes			
37. V. S., aged 36, female, white	Secondary glaucoma O.S. Onset 1 yr. High myopia. Interstitial keratitis. Positive serology	V. O.S. 20/70 T. O.S. 30–40	None
38. C. R., aged 65, female, white	Secondary glaucoma O.S. Onset 4 yrs. Normal A.C.	V. O.S. 20/70 T. O.S. 35	10/45 Iridencleisis and iridectomy O.S. T. 40 6/45 Iridocorneosclerectomy O.S. T. 50 7/45 Aspiration A.C. T. 40
39. T. S., aged 85, female, white	Secondary glaucoma O.S. Onset 5 yrs. Aphakia-cupping. Shallow A.C.	V. O.S. L.P T. O.S. 50	None
40. H. M., aged 74, male, white	Secondary glaucoma. Thrombosis central vein O.D. Shallow A.C. Disc cupped	V. O.D. H.M. T. O.D. 65+	None
Acute Glaucoma—5 Eyes			
41. J. G., aged 62, male, white	Acute hemorrhagic glaucoma. Extensive edema. Posterior synechiae. Shallow A.C. O.D.	V. O.D. N.L.P. T. O.D. 70	None
42. M. R., aged 69, male, white	Acute glaucoma O.D. Shallow A.C. Diabetes mellitus-hypertension O.D.	V. O.D. 20/100 cc. T. O.D. 60	None
43. C. T., aged 67, female, white	Acute hemorrhagic O.D. Incipient cataract. Diabetic retinopathy. Chorioretinitis O.D.	V. O.D. 20/200 cc. T. O.D. 80	11/48 Iridocorneosclerectomy O.D. T. 70
44. N. Y., aged 62, male, white	Acute glaucoma O.D. Shallow A.C. Disc cupped	V. O.D. H.M. T. O.D. 65+	None
45. A. F., aged 57, male, white	Acute glaucoma O.D. Bullous keratitis. Corneal edema; deep A.C.; deep cupping disc O.D.	V. O.D. L.P. T. O.D. 70+	None
Hemorrhagic Glaucoma—5 Eyes			
46. W. L., aged 51, male, white	Hemorrhagic glaucoma O.S. Traumatic cataract. Disc cupped; deep A.C. Hemorrhage in macular region O.S.	V. O.S. 20/80 T. O.S. 40	6/48 Cyclodialysis O.S. V. H.M. T. 50
47. I. G., aged 72, male, white	Hemorrhagic glaucoma. Diabetic retinopathy. Rubeosis iridis O.S. Aphakia; lenticular changes O.S.	V. O.S. H.M. T. O.S. 65	11/47 Trephine O.S. V. H.M. T. 50
48. A. N., aged 72, male, white	Hemorrhagic glaucoma. Atrophy; edema of cornea O.D. Disc cupped. Poor vision 10 yrs. untreated	V. O.D. H.M. T. O.D. 65	None
49. H. B., aged 60, male, white	Hemorrhagic glaucoma. Multiple thrombosis (central and secondary veins). Rubeosis iridis. Traumatic cataract 37 yrs. ago O.D.	V. O.D. F. 1' T. O.D. 55–65	None
50. E. S., aged 65, female, white	Hemorrhagic glaucoma. Diabetic retinopathy O.S. Onset 3 yrs.	V. O.S. 20/70 cc. T. O.S. 35–40	5/45 Iridocorneosclerectomy and iridectomy O.S. T. 30 6/45 Iridocorneosclerectomy O.S. T. 55 7/45 Aspiration A.C. O.S. T. 65
Buphthalmos and Hydrophthalmos—4 Cases, 5 Eyes			
51. O. E., aged 14, female, white	Hydrophthalmos - microcornea; congenital cataract. Shallow A. C. Nasal iris missing O.D.	V. O.D. L.P. T. O.D. 60	None

3/48 Cycloelectrolysis O.S. 50 punctures Electroparacentesis. Sup. keratectomy	None	5/49 V. O.S. L.P. T. O.S. 22	Tension controlled O.S. 14 mos. No visual improvement.
2/48 Cycloelectrolysis. 55 punctures O.U. 5 ma. 5 sec.	None	5/49 V. O.D. L.P. V. O.S. H.M. T. O.D. 20 O.S. 20	Tension controlled O.U. with miotics 15 mos. No fields.

4/48 Cycloelectrolysis O.S. 40 punctures 5 ma. 5 sec.	None	3/49 V. O.S. 20/50 T. O.S. 19	Tension controlled O.S. without miotics 11 mos. Vision improved. Fields unchanged postoperatively
7/45 Superficial keratectomy and cycloelectrolysis O.S. 55 punctures	7/45 Paracentesis O.S. 8/45 Trephine O.S. 10/45 Iridencleisis and iridectomy O.S.	10/47 V. O.S. 5/200 T. O.S. 26	Tension controlled with miotics. Decrease in vision.
6/48 Cycloelectrolysis O.S. 40 punctures	None	1/49 V. O.S. L.P. T. O.S. 50	No improvement.
2/48 Cycloelectrolysis and posterior sclerotomy. 50 punctures O.D.	None	1/49 V. O.D. H.M. T. O.D. 20	Tension controlled O.D. 13 mos. without miotics.

4/47 Cycloelectrolysis O.D. 45 punctures 5 ma. 5 sec.	None	5/49 V. O.D. N.L.P. T. O.D. 15	Tension controlled O.D. 23 mos. without miotics. No pain.
1/48 Cycloelectrolysis O.D. 40 punctures 5 ma. 5 sec.	None	3/49 V. O.D. 20/200 cc. T. O.D. 19	Tension controlled O.D. 14 mos. without miotics. No pain.
11/48 Cycloelectrolysis O.D. 50 punctures 5 ma. 5 sec.	None	5/49 V. O.D. 20/70 cc. T. O.D. 20	Tension controlled O.D. 6 mos. with miotics. Vision improved.
1/48 Cycloelectrolysis and paracentesis O.D. 50 punctures 5 ma. 5 sec.	None	3/49 V. O.D. H.M. T. O.D. 25	Tension controlled O.D. 14 mos. with miotics. No pain. No visual improvement.
2/48 Cycloelectrolysis and paracentesis O.D. 40 punctures 5 ma. 5 sec.	None	5/49 V. O.D. 20/200 cc. T. O.D. 22	Tension controlled O.D. 15 mos. with miotics. No pain. Vision improved.

7/48 Cycloelectrolysis O.S. 40 punctures 5 ma. 5 sec. T. 40	1/49 Cycloelectrolysis O.S. 50 punctures 5 ma. 5 sec.	5/49 V. O.S. 20/100 cc. T. O.S. 20	Tension controlled with miotics. Postoperative visual fields unchanged.
1/48 Cycloelectrolysis O.S. 50 punctures 5 ma. 5 sec. T. 35	1/48 Cycloelectrolysis O.S. 40 punctures 5 ma. 5 sec.	2/49 V. O.S. H.M. T. O.S. 20	Tension controlled with miotics. No visual improvement. No fields.
3/48 Cycloelectrolysis and aspiration A.C. O.D. 50 punctures 5 ma. 5 sec.	None	5/49 V. O.D. N.L.P. T. O.D. 20	Tension controlled O.D. 14 mos. with miotics. Vision lost.
2/48 Cycloelectrolysis O.D. 50 punctures 5 ma. 5 sec.	None	5/49 V. O.D. 10/200 cc. T. O.D. 25	Tension controlled O.D. 15 mos. with miotics. Vision improved. No fields.
7/45 Cycloelectrolysis and aspiration A.C. O.S. T. 46	7/45 Paracentesis O.S. T. 65 8/45 Trephine and peripheral iridectomy O.S.	2/49 V. O.S. 20/200 cc. T. O.S. 26	Tension controlled O.S. 32 mos. with miotics.

4/48 Cycloelectrolysis O.D.	None	3/49 V. O.D. H.M. T. O.D. 25	Tension lowered with miotics O.D.

TABLE 1—*Continued*

52. K. M., aged 5, male, white	Buphthalmos O.U. Disc normal O.U. Myopia	V. O.D. 20/50 cc. O.S. 20/70 cc. T. O.D. 55 O.S. 65	2/46 Elliott Trephine O.U. T. O.D. 55 O.S. 65
53. A. P., aged 23, male, white	Hydrophthalmos and Lagophthalmos O.U. Congenital cataract O.D. Corneal ulcers	V. O.D. L.P. T. O.D. 50	O.S. Operated upon at infancy. Atrophy following surgery with loss of vision
54. M. N., aged 16 months, female, white	Hydrophthalmos O.S. Brain hemorrhages at birth; congenital cataract. A.C. absent O.S.	V. O.S. ? T. O.S. 47	Iridectomy and needling O.U. at age of 3 mos.
Absolute Glaucoma—7 Eyes			
55. C. R., aged 65, female, white	Absolute glaucoma O.D. Onset 4 yrs.	V. O.D. N.L.P. T. O.D. 80	5/45 Cyclodiathermy with alcohol injection O.D. T. 80
56. M. R., aged 69, female, white	Absolute glaucoma Diabetes mellitus Hypertension O.S.	V. O.S. N.L.P. T. O.S. 60–70	None
57. N. C., aged 20, female, white	Absolute glaucoma Leukoma cornea and central scar O.S. Coloboma iris	V. O.S. N.L.P. T. O.S. 69	7/47 Corneal tattoo
58. J. G., aged 70, female, white	Absolute glaucoma Keratitis. Large central scar O.D.	V. O.D. N.L.P. T. O.D. 90	None
59. R. G., aged 75, male, white	Absolute glaucoma O.D. Onset 7 yrs.	V. O.D. N.L.P. T. O.D. 65+	None
60. R. M., aged 69, male, white	Absolute glaucoma O.S. Diabetic hypertension	V. O.S. N.L.P. T. O.S. 65+	None
61. P. D., aged 76, male, white	Absolute glaucoma O.S. Bullous keratitis. Lens edema. Mature cataract O.S.	V. O.S. N.L.P. T. O.S. 65	None

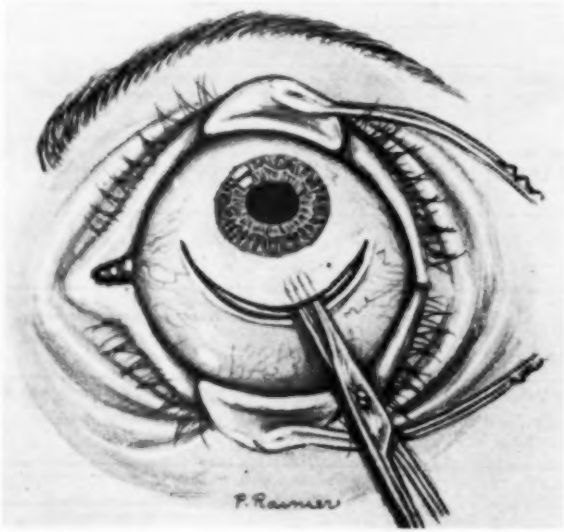


Fig. 1 (Berens, Sheppard, and Duel). If the conjunctiva is especially thick and fibrosed, it is incised 10 mm. from the limbus, extending approximately one half the circumference of the eyeball, undermined to within 1.0 mm. of the corneal limbus with Stevens scissors.

5/46 Cycloelectrolysis O.D. 55 punctures 6/46 Cycloelectrolysis O.S. 55 punctures	None	5/49 V. O.D. 20/40 cc. O.S. 20/40 cc. T. O.D. 22 O.S. 22	Tension controlled O.U. 3 yrs. without miotics. Vision improved. Preoperative concentric fields unchanged postoperatively.
4/48 Cycloelectrolysis and iridocapsulotomy O.D. Sup. keratectomy O.D. 32 punctures	None	2/49 V. O.D. 20/70 T. O.D. 18	Tension controlled. Vision improved. No fields.
2/48 Cyclodiathermy O.S. 25 punctures 5 ma. 5 sec.	None	5/49 V. O.S. ? T. O.S. 20	Tension controlled with miotics. Too young to accurately measure vision.

7/45 Superficial keratectomy and cycloelectrolysis O.D.	2/46 Evisceration O.D.		Eye became soft and dangerous.
1/48 Cycloelectrolysis O.D. 50 punctures 5 ma. 5 sec.	2/48 Cycloelectrolysis O.D. T. 40; 40 punctures 3/48 Cycloelectrolysis. 50 punctures	5/49 T. O.D. 19	Tension controlled 14 mos. without miotics. No pain.
2/48 Cycloelectrolysis O.S. 50 punctures	None	3/49 T. O.S. 26	Tension controlled without miotics 13 mos. No pain.
4/48 Cycloelectrolysis and aspiration A.C. O.D. 50 punctures	None	5/49 T. O.D. 22	Tension controlled 13 mos. without miotics. No pain.
5/48 Cycloelectrolysis O.D. 50 punctures. Paracentesis	5/48 Enucleation O.S.		Eye became hypotonic.
11/48 Cycloelectrolysis O.S.	None	2/49 T. O.S. 50	Tension lowered slightly. No pain.
3/48 Cycloelectrolysis O.D. 50 punctures 5 ma. 5 sec.	None	5/49 T. O.D. 20	Tension controlled without miotics 14 mos. No pain.

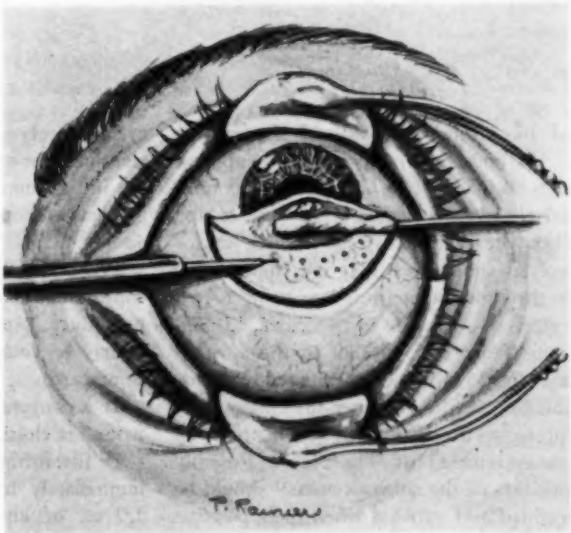


Fig. 2 (Berens, Sheppard, and Duel). Galvanocautery punctures are applied to the sclera 1.0 and 3.0 mm. from the surgical limbus, using a 1.5-mm. straight needle.

The inferior half of the globe is usually selected as the preferable site for operation, conserving the upper half for possible subsequent surgery.

Procedure when the conjunctiva is unusually fibrosed and thick.

The globe is retracted superiorly and the conjunctiva is incised 10 mm. from the limbus, extending over the lower half of the globe.

The conjunctiva is thoroughly undermined to within one mm. of the limbus (fig. 1) and the punctures are applied through the sclera (fig. 2), using a 1.5 mm. special electrolysis needle.

When the conjunctiva is normal, cycloelectrolysis punctures may be applied directly through the conjunctiva, using a two mm. electrolysis needle in two rows, 1.0 and 3.0 mm. from and parallel to the surgical limbus (fig. 3) which is determined by transillumination. In this manner the ciliary body and processes are affected as demonstrated by the measurements of Troncoso.[10] Possibly the position of the aqueous veins[11] should be determined and avoided when their position is known.

From 30 to 70 punctures have been used, depending upon the degree of intraocular pressure. In cases which did not respond satisfactorily to the original treatment, the procedure has been repeated in another area with no apparent deleterious effects upon the eye. Too few operations have been performed to establish a workable formula whereby the number of punctures may be accurately calculated. At the present time we believe that in many of the cases in which cycloelectrolysis was employed an insufficient number of punctures was made and that the initial number of cycloelectrolysis punctures at one operation should be between 50 and 75.

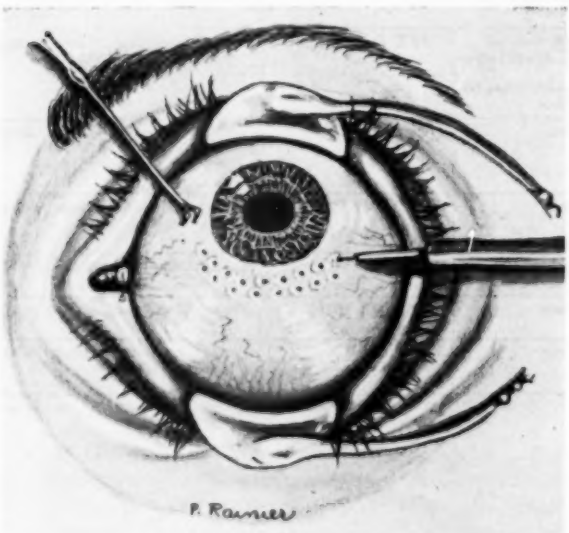


Fig. 3 (Berens, Sheppard, and Duel). If the conjunctiva is normal, the galvanocautery punctures are applied through the conjunctiva, using a 2.0-mm. straight conical electrolysis needle.

Cycloelectrolysis performed through the conjunctiva has been found to be a safe procedure, causing so slight a reaction that it may be considered an office procedure in some cases.

If a conjunctival flap has been made, the wound is closed with silk or plain 5-0 catgut.

If the intraocular pressure remains high immediately following surgery, from 0.5 to 1.0 cc. of aqueous is aspirated from the anterior chamber.

A solution of atropine (one percent) is instilled, 1:3,000 metaphen unguent ophthalmic is applied, and a monocular dressing placed over the eye.

Postoperative treatment

Postoperative care is important. The head and torso should be elevated but rest in bed is unnecessary. Atropine (1.0 percent) or hyoscine (0.25 percent) solution should be used to immobilize the iris and ciliary body and to lessen congestion. The use of neosynephrin (1.0- to 2.5-percent solution) may be helpful in lessening congestion and in producing mild dilation of the pupil.

Complications

We have previously stated that because cycloelectrolysis produces such a mild reaction the complications which may result are relatively infrequent.

1. Iridocyclitis. A mild reaction is present in the ciliary body following cycloelectrolysis. This may be controlled by the use of atropine postoperatively and will prevent the formation of synechias. A positive aqueous beam, when present, is usually of short duration.

2. Corneal anesthesia. Some of our patients have had bullous keratitis preceding surgery, due to persistent high tension, but we have not found this complication following cycloelectrolysis. The relief of pain is a most striking and consistent postoperative finding following cycloelectrolysis. It is probable that the corneal anesthesia which may be present subsequent to the operation is caused by trophic changes affecting the branches of the ciliary nerve.

3. Intraocular hemorrhage. The complications of intraocular hemorrhage, opacities in the lens, sympathetic ophthalmia, and herniation of the ciliary body into or through the sclera have not been observed in our series of cases.

4. Hypotony and detachment of the retina. In one case (Table 1, Case 29) in which cycloelectrolysis was performed (50 punctures) hypotony developed following a series of operations for glaucoma following cataract extraction, including cyclodiathermy, and was followed by retinal detachment. A severe hyperplastic sphenoiditis and serious psychologic factors complicated this case. The vision had been lost before cycloelectrolysis because the glaucoma secondary to uveitis had been diagnosed as facial neuralgia by a general physician.

Results of cycloelectrolysis

The results of cycloelectrolysis obtained in 65 eyes are tabulated in Tables 1 through 7.

Discussion

The tables show the results in 65 eyes following cycloelectrolysis for various types

TABLE 2

RESULTS OF CYCLOELECTROLYSIS FOR GLAUCOMA ON VISUAL ACUITY, TENSION AND VISUAL FIELDS IN 65 EYES OBSERVED FROM SIX MONTHS TO FOUR YEARS

	No. of Eyes			No. of Eyes	
Vision improved	25 (39%)	71%	Controlled without miotics	28 (43%)	84%
Vision unchanged	21 (32%)		Controlled with miotics	27 (41%)	
Vision decreased	14 (21%)		Uncontrolled	5 (8%)	
3 / 2	(8%)		Enucleated / Eviscerated	3 / 2	(8%)
65			Total	65	

Visual fields not recorded because of poor preoperative or postoperative vision: 42 eyes

Results of visual fields in remaining 18 eyes:

Improvement	2 (11%)	78%
Stationary	12 (67%)	
Slight contraction	4 (22%)	

TABLE 3

RESULTS OF CYCLOELECTROLYSIS FOR CHRONIC PRIMARY GLAUCOMA IN 21 PATIENTS, 23 EYES

No. of Eyes		Tension	No. of Eyes	
Vision improved	10 (44%)	Controlled without miotics	13 (57%)	92%
Vision unchanged	6 (26%) 70%	Controlled with miotics	8 (35%)	
Vision decreased	6 (26%)	Uncontrolled	1 (4%)	
1 (4%) Enucleated (Case 16)			1 (4%)	
23		Total	23	

Visual fields:

Improved	2 (15%)	77%
Stationary	8 (62%)	
Contraction	3 (23%)	
Not recorded (poor vision)	10	

Patients observed from 6 months to 4 years.

of glaucoma on patients observed from six months to four years.

Because most of these operations were performed on eyes with advanced glaucoma, many of which were considered hopeless and had had previous operations, no final evaluation of the procedure can be considered until many more operations have been performed and the results have been critically analyzed. However, the results are sufficiently encouraging for the procedure to be recommended to others for trial.

Twenty-nine eyes had previous surgery performed (from 1 to 4 operations) which not only failed to control tension but was associated with decrease in vision and further

TABLE 4

RESULTS OF CYCLOELECTROLYSIS FOR SECONDARY GLAUCOMA

Secondary glaucoma following cataract extraction—nine eyes

No. of Eyes		Tension	No. of Eyes	
Vision improved	4 (44%)	Controlled without miotics	3 (33%)	55%
Vision decreased	3 (33%)	Controlled with miotics	2 (22%)	
		Uncontrolled	2 (22%)	
1 Enucleation—detached retina			1	(22%)
1 Evisceration—hypotonic			1	
9		Total	9	

Secondary glaucoma following trauma—three eyes

Vision improved	1 (25%) 100%	Controlled without miotics	2 (75%)	100%
Vision unchanged	2 (75%)	Controlled with miotics	1 (25%)	
3		Total	3	

Secondary glaucoma associated with uveitis—four eyes

Vision unchanged	4 (100%)	Controlled without miotics	2 (50%)	100%
		Controlled with miotics	2 (50%)	
4		Total	4	

Secondary glaucoma, miscellaneous—four eyes

Vision improved	1 (25%) 75%	Controlled without miotics	2 (50%)	75%
Vision unchanged	2 (50%)	Controlled with miotics	1 (25%)	
Vision decreased	1 (25%)	Uncontrolled	1 (25%)	
4		Total	4	

Patients observed from 10 to 34 months.

TABLE 5

RESULTS OF CYCLOELECTROLYSIS FOR ACUTE GLAUCOMA—FIVE EYES

	No. of Eyes		Tension	No. of Eyes	
Vision improved	2 (40%)	80%	Controlled without miotics	2 (40%)	100%
Vision unchanged	2 (40%)		Controlled with miotics	3 (60%)	
Vision decreased	1 (20%)				
5			Total	5	

Results of cycloelectrolysis for hemorrhagic glaucoma—five eyes

	No. of Eyes		Tension	No. of Eyes
Vision improved	1 (20%)	40%	Controlled with miotics	5 (100%)
Vision unchanged	1 (20%)			
Vision decreased	3 (60%)			
5			Total	5

Patients observed from 12 to 32 months.

TABLE 6

CYCLOELECTROLYSIS FOR GLAUCOMA—FOUR CASES, FIVE EYES

Hydrophthalmos	No. of Eyes		Tension	No. of Eyes	
Vision improved	4 (80%)	100%	Controlled without miotics	2 (40%)	100%
Too young to examine	1 (20%)		Controlled with miotics	3 (60%)	
5			Total	5	

Patients observed from 11 to 26 months.

TABLE 7

CYCLOELECTROLYSIS FOR GLAUCOMA—SEVEN EYES

Absolute glaucoma—preoperative vision—seven eyes

	Tension		
No light perception	Controlled without miotics	3 (43%)	57%
	Controlled with miotics	1 (14%)	
	Uncontrolled	1 (14%)	
	Enucleated	1	(29%)
	Eviscerated		
	Total	7	

Patients observed from 11 to 13 months.

constriction of visual fields. Fourteen eyes required additional surgery following cycloelectrolysis to lower further or control tension. In three of these cases, cycloelectrolysis had to be repeated, apparently due to the fact that an insufficient number of punctures was applied at the first operation.

CASE REPORTS

Case 17. H. R., a Negro, aged 54 years, complained of blurring of vision and rainbow colors for three days prior to examination. Uncorrected vision was: O.D., 20/40−1; O.S., 20/30. Intraocular pressure was: O.D., 48 to 65 mm. Hg (Schiøtz); O.S., 30 mm. Hg (Schiøtz). Slitlamp examination revealed edema of the corneal epithelium, O.D.; no cupping of the discs. Anterior chamber was normal, O.U. There was a generalized constriction of the peripheral fields and bilateral enlargement of the blindspots (fig. 4A). A diagnosis of chronic primary glaucoma was made and the patient was given medical treatment for six months.

Thirty-six cycloelectrolysis punctures (five ma.

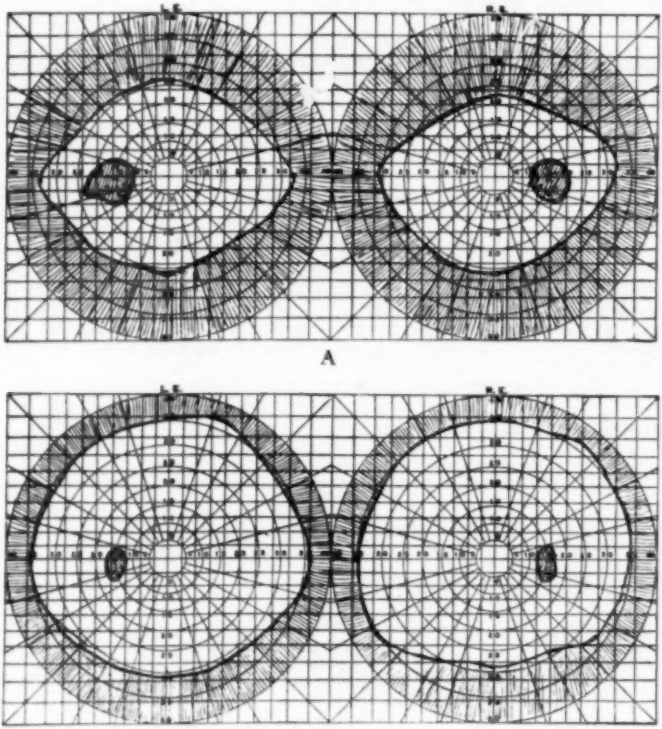
for five sec.) were made over the ciliary body in the lower half of the right eyeball by Dr. Truman Boyes. Intraocular pressure, O.D., was reduced to 20 mm. Hg (Schiøtz), and maintained for 10 days but then gradually increased over a period of three months to 50. mm. Hg (Schiøtz) despite medical treatment. Vision was 20/20 in both eyes. Tension, O.S., was 20 mm. Hg (Schiøtz).

Thirty-two additional punctures were made through the conjunctiva (five ma. for five sec.) in the upper half of the right eyeball. The tension was reduced to 20 mm. Hg (Schiøtz) and vision was 20/70—3, O.D.

Two months later, tension of the left eye fluctuated from 24 to 45 mm. Hg (Schiøtz). Fifty cycloelectrolysis punctures (five ma. for five sec.) were made through the conjunctiva with a 2.0-mm. needle on the inferior half of the left eye, combined with aspiration of 0.5 cc. of aqueous. Tension in both eyes remained normal for 11 months without medication and vision improved to 20/20 in each eye, without correction. The peripheral visual fields and blindspots returned to normal (fig. 4B).

Case 19 (Chronic primary glaucoma). H. K., was a Negress, aged 43 years. Cycloelectrolysis was employed as a primary procedure on the left eye, and cyclodiathermy was performed on the right eye. The tension in the eye on which cycloelectrolysis was performed was controlled without further surgery, but the eye on which cyclodiathermy was employed required cycloelectrolysis, trephination, iridencleisis, and sclerotomy before the tension was finally controlled.

Case 62 (Iridocyclitis [sarcoidosis] with secondary glaucoma). (Not included in tables because six months have not elapsed from time of operation.)



A

B

Fig. 4 (Berens, Sheppard, and Duel). Comparison of preoperative (A) and postoperative (B) fields in a Negro patient with chronic simple glaucoma. (A) Preoperative fields, July 1, 1946, for a 2/1,000 white test object. Peripheral fields are generally constricted and there is a bilateral enlargement of the blindspots. (B) Postoperative fields, April 17, 1949, for a 2/1,000 white test object. Peripheral fields for both eyes are normal and there are no scotomas.

P. S., a Negro, aged 26 years, entered the hospital on December 22, 1948, complaining of failing vision in each eye with occasional pain which, at times, was severe in the left eye.

Past history. The patient had been told that there was an increase in the intraocular pressure in June, 1948, which was controlled by miotics. Vision on admission was 20/70 in the right eye and 20/200 in the left eye. The tension was 35 mm. Hg (Schiøtz), O.D., and 40 mm. Hg (Schiøtz), O.S., Slitlamp showed the usual findings of iridocyclitis. Examination of a lymph node revealed sarcoidosis.

Under conservative treatment the tension of the left eye varied from 30 to 65 mm. Hg (Schiøtz). The tension was not controlled with miotics, mydriatics, or vasoconstrictors which were used in conjunction with aspiration of the anterior chamber. The left visual field showed definite constriction of the superior nasal quadrant and it was considered wise, even in the face of a moderately advanced iridocyclitis, to perform cycloelectrolysis.

On January 13, 1949, 30 punctures were made over the inferior nasal quadrant by one of us (L. B. S.) using five ma. for five seconds of negative galvanic current. The tension subsided slightly but again became elevated to 42 mm. Hg (Schiøtz), and cycloelectrolysis was repeated on March 3rd, using 70 punctures, five ma. for five seconds over the temporal half of the globe. During the subsequent two weeks the tension in the left eye dropped to 14 mm. Hg (Schiøtz) but gradually became elevated to 40 mm. Hg (Schiøtz) where it has remained with very little fluctuation. The patient retains 20/200 vision in the left eye, has no pain, and the field is unchanged.

Comment. The iridocyclitis was not aggravated by either of the above cycloelectrolysis operations.

Summary and Conclusion

1. Cycloelectrolysis (cyclocatholysis) is a new operative technique in the field of glaucoma, giving the surgeon an accurately controlled method of chemically destroying the tissues of the ciliary body.

2. This procedure has been used over a period of four years and critical investigations have been carried out on 65 human (observed from six months to four years) and 80 animal eyes.

3. The technique of cycloelectrolysis is simple and requires no elaborate equipment, and only ordinary skill on the part of the surgeon.

4. The procedure consists essentially of treating the lower half of the eyeball with from 50 to 75 punctures made with a fine conical straight needle. A needle, 1.5 mm. in length, is used through the sclera, and a 2.0 mm. needle through the conjunctiva between 1.0 and 3.0 mm. from and parallel to the surgical limbus using five milliamperes of galvanic current (cathode) for five seconds.

5. Because the operative and postoperative reaction is slight and complications infrequent, the operation may be performed as an office procedure.

a. There is no marked postoperative rise in intraocular pressure such as that which occurs following nonperforating cyclodiathermy because of contraction of the sclera and greater secondary congestion.

b. There is no carbonization of tissue around the puncture wounds or thinning of the sclera, thereby avoiding the possibility of herniation of the ciliary body into the scleral defect.

c. The punctures may be safely made through the conjunctiva. In cycloelectrolysis the minute punctures are sterilized chemically and are immediately sealed with serum, reducing the likelihood of infection.

d. There is less congestion of ocular tissues in cycloelectrolysis as compared with cyclodiathermy.

e. The chemical destruction of the ciliary body from electrolysis may be less dangerous than the destruction produced by diathermy from the standpoint of sympathetic ophthalmitis (chemical versus thermal destruction).

6. Cycloelectrolysis is indicated particularly in elderly people where the complications of thrombosis, pneumonia, and infections may occur due to the recumbent position. Patients need not be confined to bed following this operation.

7. The Negro race is susceptible to cicatrix and keloid formation and it is generally recognized that Negroes usually do not respond to a filtering operation. Cycloelectrolysis therefore should be of value in the Negro and was successful in controlling tension in seven eyes.

8. The relief of pain is the most striking

and consistent postoperative finding. There has been a decrease of tension in most cases (84 percent), no loss of vision has been found in many of the cases (71 percent). The visual fields were retained without deterioration in the majority of cases (78 percent).

9. Results following cycloelectrolysis are so encouraging that the procedure warrants consideration, investigation, and clinical trial by other ophthalmologists.

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CHRONIC SIMPLE GLAUCOMA IN THE NEGRO

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Glaucoma is a very common cause of blindness in both the white and Negro races. To ophthalmologists who practice in the South, glaucoma in the Negro is encountered frequently and, due to the poor results in the treatment, it serves as a constant challenge. The poor results in the treatment of glaucoma in the Negro and the paucity of literature on this subject prompted the writing of this paper.

Incidence

Glaucoma ranks second in incidence in each 10-year age group after 40 years of age, following optic atrophy at the ages of 40 to 49, and cataract thereafter. Its proportion of all cases is highest, about 20 percent, in the age-at-onset interval 60 to 69 years. According to a Federal Security Agency[1] report, glaucoma is a more frequent cause of blindness in the Negro than in the white race, since as the proportion of all glaucoma cases was higher in the Negro, 15.5 percent of all Negroes receiving aid for blindness as compared to 11.2 percent in the white race. Negroes constituted 20 percent of all recipients but accounted for 29 percent of the glaucoma cases receiving aid for the blind.

Lehrfeld and Reber[2] found, in their review of the records of 242,533 eye patients, that 0.78 percent had glaucoma. The incidence of glaucoma in eye patients varied from 0.4 percent in Gottingen to 2.6 percent in India. Rouse[3] studied 13,522 records of eye patients at New Orleans Eye, Ear, Nose, and Throat Hospital, of which 122 had chronic simple glaucoma or an incidence of 0.9 percent.

Sex

Lehrfeld and Reber[2] reported glaucoma in 514 females and 509 males. Rouse[3] found

64 percent of his cases of glaucoma in women and 35.3 percent in men. Duke-Elder states that chronic simple glaucoma is more common in the male.

Age

In Rouse's[3] study, the average age of glaucoma among white persons was 57 years, while in the Negro it occurred at an average age of 47 years. These statistics are significant, especially in view of the fact that the Negro does not seek eye care until the glaucoma is far advanced. Within the past year I have operated on three Negroes (two male and one female) under 40 years of age with far-advanced glaucoma.

Race

Rouse[3] found glaucoma in 54.1 percent of white and 45.9 percent of colored patients in a large hospital clinic where more than 50 percent of the patients were colored. Lehrfeld and Reber[3] did not break their statistics down into races, but stated that glaucoma was not more common in the Jewish people. Iliff[4] did not state the percentage of whites to Negroes in his study, but only compared his surgical results in the Negro with other results obtained in the white race. Lange[5] quoted Rydel, Rosas, Sichel, and Von Arlt as believing that glaucoma occurs in brown eyes in the majority of cases. He expressed the opinion that the dark iris, with its greater amount of pigment, might be thicker than the light iris and impinge more on the angle of the anterior chamber. Scott[6] studied the eyes of 2,000 West African Negroes and compared them to the eyes of Europeans and found the most obvious difference was in pigmentation and the need for stronger mydriatics to dilate the pupil in the Negroes. Allen and Ackerman[7] state that in five members of the family which they reported as having hereditary glaucoma, four had brown irides and the fifth had blue irides.

Coppinger[8] found a positive Wassermann reaction in 29.8 percent of 205 cases of glaucoma seen at the Calcutta Eye Infirmary and was of the opinion that the syphilis should be treated before a trephining operation was done because he felt that syphilis increased the formation of inflammatory exudates which closed up the trephine opening. He also felt that often in a trephining operation the deeper part of Descemet's membrane, which is transparent, is left behind and causes blockage of drainage.

Glaucoma in China is frequently treated by quacks, and of the cases of glaucoma seen by Pillat,[9] 48.5 percent were blind in both eyes and 31.2 percent were blind in one eye.

Medical treatment

The medical treatment of chronic simple glaucoma in the Negro is, in most cases, very unsatisfactory for many reasons. Most of the cases of glaucoma seen in the Negro are far advanced when first seen by an ophthalmologist. Many of these patients have lost the vision of one eye and the other eye is far advanced with the disease. It is quite rare to find a case of early glaucoma in the Negro, although we know that it exists. It is possible and not unlikely that the interval between the time of the beginning field loss and slight elevation of the intraocular pressure and the time of far-advanced glaucoma may be much shorter in the Negro than in white persons.

Negroes, as a rule, like to take medicine, but many of them will not use miotics regularly for long periods of time. The intelligence quotient of many of them is so low that one cannot impress upon them the importance of their medication and follow-up care. Many of these Negroes live great distances from the ophthalmologist and it is difficult for them to report very often for proper field studies and tonometric examinations.

McDonald[10] states that di-isopropyl-fluorophosphate (D.F.P.) is equally effective in Negroes and in whites in reducing the tension, and the frequency of medication required to control the glaucoma was the

same in both groups. He reported control of tension in 57.4 percent of these glaucomatous eyes which had not previously been controlled with other miotics. I have not used di-isopropyl-fluorophosphate but, in my experience, practically 100 percent of all cases of glaucoma in the Negro come to surgery. The greatest use of miotics in the Negro is after surgery when the intraocular pressure will not remain normal.

Bloomfield[11] has shown that patients with chronic simple glaucoma have a greatly reduced amount or no parasympathomimetic activity in their aqueous humor and that this relative deficiency was not altered by filtering operations. This finding is in keeping with the observation made by Schoenberg[12] that glaucoma might be a deficiency disease. It is possible that the Negro may have some deficiencies, but nothing of this nature has been found.

Results of questionnaire

A questionnaire consisting of six questions relating to chronic simple glaucoma in the Negro was sent out to 125 ophthalmologists in different sections of the United States. The answers to the questions were most enlightening. The total answers to some of the questions are not the same as to other questions. This discrepancy is due to the fact that all of the ophthalmologists did not answer every question in the questionnaire. Most of the questions are related to surgery of glaucoma in the Negro, and each of these phases will be discussed under the separate questions.

Question 1. What is your first choice of operation for chronic simple glaucoma in the Negro?

The questionnaire showed that more ophthalmologists preferred iridencleisis (43 or 56.5 percent) to all other types of operation combined (33 or 43.5 percent). Some type of trephining operation was second to iridencleisis and 19 ophthalmologists list trephination as their first choice of operation.

Iliff[4] reported 51 percent of primary glaucoma cases successfully operated on in the Negro by iridencleisis as an initial operation against 23 percent with trephination, and no successful case with iridectomy. Some of his cases were operated on more than one time, and he states that 54.2 percent of cases of primary glaucoma in the Negro were controlled by a filtering operation. He prefers the iridencleisis as the initial operation. He states that nearly all of his cases were advanced cases, and being able to control the tension in 54.2 percent of these Negroes with primary glaucoma is an excellent record.

Randolph and Robertson[13] reported success in 59 percent of all cases, both early and late, of primary glaucoma in the white race, while they were successful in only 37 percent of the late cases. They did not find any material difference in results following iridencleisis or trephination. They also state, along with Reese,[14] that all cases in Negroes were excluded from their statistics, the reason being that the course of the disease in this race is notoriously unsatisfactory, and the operative results equally so.

Four ophthalmologists preferred a modified Lagrange operation, three cyclodiathermy, three cyclodialysis, two iridectomy, one Herbert's trap-door sclerotomy, and one, cycloelectrolysis.

Iridencleisis would seem to be the operation of choice in the Negro; rarely should a trephining operation be performed because of the closing up of the trephine opening with cicatricial tissue.

Conrad Berens[15] prefers cycloelectrolysis which is a new procedure designed to reduce the amount of aqueous by chemical destruction and subsequent atrophy of a portion of the ciliary body and its processes with the least possible trauma and fewest complications. He states: "It is a well-established fact that the Negro does not respond to the usual filtering operations due to excessive keloid formation, and I believe cycloelectrolysis to be the operation of choice."

Question 2. What is your second choice of operation for chronic simple glaucoma in the Negro?

Trephination is the favorite second-choice operation (42 percent), followed by iridencleisis (25.9 percent), cyclodiathermy (11.4 percent), cyclodialysis (8.5 percent), modified Lagrange (5.7 percent), and all other operations (4.2 percent).

The second-choice operation in chronic simple glaucoma is important because so often it has to be used. I prefer cyclodiathermy puncture as a second-choice operation in glaucoma in the Negro. If an iridencleisis operation plus use of miotics does not relieve the increased intraocular pressure, cyclodiathermy puncture should be done.

Beta irradiation on the blebs was used by Iliff[4] in 11 eyes with encouraging results, and he is of the opinion that it should be used more often. He felt that beta irradiation helped to prevent formation of cicatricial tissue and thus gave the operation a better chance of success.

Question 3. Are you as satisfied with your results in the Negro race as you are with your results in the white race?

Only 17.5 percent of the ophthalmologists were as satisfied with results in chronic simple glaucoma in the Negro compared with 82.5 percent who were less satisfied with their results.

My results in treating chronic simple glaucoma in the Negro have been poor. Often more than one operation is necessary as well as the use of miotics postoperatively. Many of the far-advanced cases go on to blindness in a short time even though the operation reduces the intraocular pressure to normal. Few ophthalmologists can boast of such an excellent record as that reported by Iliff.[4]

The pessimism of ophthalmologists toward chronic simple glaucoma in the Negro is warranted, and the reasons for the poorer results obtained in the Negro are as follows:

a. Most of the cases in Negroes are far advanced when first seen by an ophthalmologist, and in many of these cases, even if intraocular pressure is made normal, the field changes and loss of vision continue. Reese[14] stated that of the late cases, 60 percent showed progressive contraction of visual fields in spite of the fact that intraocular pressure had been reduced to normal over the five-year follow-up period. This would indicate that, if vascular changes occasioned in the retinal blood vessels by the increased intraocular pressure and producing the peripherial field contractions have reached a certain degree or have gathered a certain momentum, so to speak, they continue to progress, thus producing progressive field defects in spite of normal intraocular pressure.

b. The difficulty in obtaining proper cooperation with Negroes whether for medical or after-surgical treatment is due to ignorance, indifference, long distances necessary to travel to consult an opthalmologist, and economic reasons. It is often difficult to make an illiterate Negro living 60 to 80 miles from an ophthalmologist understand the importance of using miotics regularly and to return for frequent field studies and tonometric readings. Education, improved transportation, and better financial status will help to improve the results in chronic simple glaucoma in the Negro more than any surgical procedure utilized at present.

c. After filtering operations of any type, there is a marked inclination for the bleb to cicatrize in the Negro and nullify the operation. Beta irradiation, as previously stated, offers some hope of success in some of these cases.

d. Syphilis in a high percentage of Negroes—Coppinger[8] thinks that syphilis increases inflammatory exudates and causes closure of the trephine opening.

e. Improper selection of operation or its improper performance. Even though iridencleisis is the first-choice operation for chronic simple glaucoma in the Negro, there

are times when other types of operation might give a greater degree of success. In operating upon the Negro for chronic simple glaucoma, it is necessary to do the filtering operation farther back from the limbus than in the white, because there is an early flaying out of Tenon's capsule. If one is not careful in dissecting Tenon's capsule and placing the filtering opening, he will find his opening anterior to Tenon's capsule and the operation will probably not be successful.

Question 4. Do you use cyclodiathermy? If so, which do you prefer, cyclodiathermy puncture or surface applications?

About two thirds of the opthalmologists use cyclodiathermy, and the cyclodiathermy puncture is about three times as popular as surface applications. It seems that cyclodiathermy has a definite field of usefulness in glaucoma of the Negro. There seems to be an increasing interest in cyclodiathermy since Vogt,[16] in 1937, applied diathermy to the ciliary body. The operation consisted of a great number (100 or more) of transcleral punctures made with a special needle. Wagner and Richner,[17] in 1939, reported 47 operations following Vogt's method, with 72 percent successful.

In 1943, Albaugh and Dunphy[18] presented a paper on cyclodiathermy in which they described two kinds of operations: (1) Perforating punctures according to Vogt's technique, and (2) a nonperforating diathermy with a flat electrode of the Weve type: The authors preferred the latter method.

In 1944, Dupont Guerry, III,[19] published a report of his experiments on the use of diathermy to block the long posterior ciliary arteries and thus obstruct the circulation of the ciliary body. He was able to reduce the intraocular pressure for a period of about two weeks and suggested that it could be used as a preliminary operation to cyclodiathermy to prevent the initial rise of pressure which often follows cyclodiathermy. His studies give added support to the teaching that the horizontal meridian should be avoided in retinal detachment operations because, if a long posterior ciliary artery is inadvertently coagulated, hypotony results during the very interval when a normal or slightly elevated tension is desirable.

Stocker[20] has used cyclodiathermy puncture in the Negro in cases of primary glaucoma in which no other operation had previously been used and reports good results. He feels that the operation with a somewhat improved technique has much to offer in cases of primary glaucoma in the Negro.

Troncoso[21] performed experiments on rabbits with different methods of destroying the action of ciliary processes by diathermy and was of the opinion that, from the standpoint of permanently lowering the intraocular pressure, the results from cyclodiathermy were disappointing.

Berens,[15] as previously stated, thinks electrodialysis has much to offer for glaucoma in the Negro. I have had no experience with this method.

Lutman[22] performed nonperforating diathermy on 28 eyes afflicted with various types of glaucoma and found the operation mostly successful in the aphakic group where, in 5 of 6 cases, intraocular pressure was controlled. He believes that the operation is particularly suited to cases of glaucoma in which iris vascularization precludes surgery upon the iris, and to glaucoma secondary to central venous thrombosis.

deRoetth[23] reported treatment by cyclodiathermy in two cases of glaucoma due to rubeosis iridis diabetica in which the pain was entirely relieved. Both patients were practically blind at time of operation. No previous operations for glaucoma had controlled the pain.

I have used diathermy puncture as a second-choice operation in six patients (eight eyes) and have controlled the pressure of three patients in which an Elliot trephining operation did not control the tension, and one case in which a modified Lagrange had been unsuccessful.

Not over 75 diathermy punctures should be

used on an eye. I have used cyclodiathermy puncture on two eyes as an initial operation, and the pressure in one of the eyes has remained within normal limts for over four years without use of miotics. The tension in the other eye has been fairly well controlled with two-percent eserine solution.

Question 5. Do you think chronic simple glaucoma is more common in the Negro than in the white race?

About one third (33.9 percent) thought glaucoma was more common in the Negro, while 66.1 percent did not believe it to be more common. Rouse's[3] study in New Orleans agrees with this view, while a Federal Agency[1] thinks that glaucoma is more common in the Negro. Glaucoma may not be more common in the Negro but, due to the difficulty in treating these cases, with very often poor results, we may be more impressed with cases in the Negro than the actual number of cases would warrant.

Question 6. Have you noticed any anatomic, physiologic, or pathologic difference in the eyes of Negroes as compared to the eyes of the white race?

Three fourths (74.5 percent) of the ophthalmologists felt that there were anatomic, physiologic, or pathologic differences, and 25.5 percent did not think so.

Feeling that chronic simple glaucoma is a much more difficult disease to treat in the Negro, the answer may be found in some of the differences in the eyes of the two races. The most common differences were:

a. Increased pigmentation of the uveal tract which may have some bearing on the angle and also may account for more inflammatory reaction after surgery. The difficulty in dilating the pupil of a Negro with the common mydriatics is also probably caused by the increased pigmentation of the uveal tract.

b. The marked tendency in the Negro of scar-tissue formation, not only following surgery to the eye, but on most other portions of the body. This tendency to cicatricial formation is one of the most common reasons for poor surgical results in the Negro.

c. Tenon's capsule is thick and flays out early, making it necessary to stay quite a distance back from the limbus to get satisfactory results in filtering operations. Constantine[24] has stressed this point previously in discussing glaucoma.

Summary

1. Glaucoma is more common in the white race but appears to be of a more malignant type in the Negro.

2. Medical treatment of chronic simple glaucoma in the Negro is usually unsatisfactory.

3. Iridencleisis is first choice of operations for chronic simple glaucoma in the Negro.

4. A trephining operation is second choice of operations in chronic simple glaucoma in the Negro.

5. Eighty-two percent of the ophthalmologists questioned were dissatisfied with treatment of chronic simple glaucoma in the Negro.

6. About two thirds of the ophthalmologists questioned use cyclodiathermy for chronic simple glaucoma in the Negro and many more use cyclodiathermy puncture than surface applications.

7. Attempts at reducing the secretion of aqueous by the ciliary process in the human by cyclodiathermy puncture and surface applications have been tried; cycloelectrolysis and coagulation of one long posterior ciliary artery have also been used. In view of the poor results obtained in glaucoma in the Negro by medical treatment and the usual filtering operations, it is not unlikely that our best method of treating these cases may lie in some operation which inhibits the secretion of aqueous.

8. Reasons for poor results in operative treatment of chronic simple glaucoma in the Negro are:

a. Most cases of glaucoma in the Negro are far advanced when first seen by an ophthalmologist.

b. Difficulty in obtaining proper coöperation with Negro patients for follow-up.

c. Marked tendency for the trephine opening to become closed with cicatricial tissue after operation in the Negro.

d. Improper selection of operation and improper performance of operation.

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DIFFERENTIATION OF PHI PHENOMENON AND PARALLAX*

THE USE OF PHI PHENOMENON IN DETERMINATION OF RETINAL CORRESPONDENCE

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The use of the phi phenomenon in measuring the degree of heterophoria is frequently described in the literature. It is, however, erroneously referred to as the parallax test. Not only is the test misnamed, but descriptions and explanations of it which appear in current ophthalmic literature indicate a misunderstanding of the true nature of the test, as well as a possible misinterpretation of the results. Under this false name the test is presumed to measure heterotropia. Since the phi phenomenon, as elicited by the cover test, measures phoria and not tropia, and actually might be used to differentiate tropia from phoria, it obviously must be distinguished from parallax.

The phi phenomenon is defined by Verhoeff:[1] "When the eye is exposed to a stimulus which is extinguished and then to a similar one in another place, the two stimuli may be perceived as a single stimulus which has moved across the intervening space." A psychologist's definition is:[2] "If two disks of light are presented briefly to different areas of the retina, movement tends to appear in the direction of the succession." Wertheimer[3] was the first investigator to name the sensation of movement the phi phenomenon.

MONOCULAR PHI PHENOMENON (fig. 1)

When retinal points A and B are successively stimulated, the sensation is the same as if all the intervening points between A and B were stimulated in order. This effect may be secured by flashing lights alternately at D and E. There is an optimum rate of speed for the lights to be flashed to elicit the sensation of movement. If the speed is too slow, the lights are seen alternately. If the interval between flashes is less than the time of persistence of sensation, the lights are seen simultaneously. When the speed is about 1/15 or 1/20 second, movement of the light from D to E and from E to D is seen.

Fig. 1 (Franklin). Monocular phi phenomenon.

BINOCULAR PHI PHENOMENON (fig. 2)

When there is binocular fixation on some point, D, both eyes are stimulated identically when a light at D is extinguished and another light appears at E. It can be seen by comparing Figures 1 and 2 that the binocular phenomenon differs in no important respect from the monocular, corresponding retinal points, A and A′, acting as a unit, and corresponding points, B and B′, acting as a unit. When these pairs of retinal points are alternately stimulated, apparent movement of the light, from D to E and from E to D, takes place as already indicated.

* From the Department of Ophthalmology, University of Southern California, School of Medicine, presented at the eighth annual meeting of the American Association of Orthoptic Technicians, Chicago, October, 1949.

Familiar examples of the phi phenomenon are motion pictures and electric advertising signs, where a series of "stills" give the illusion of motion.

Anatomic basis of the phi phenomenon

Anatomically there is not a point-to-point relationship between the retinal elements and the cortical higher centers. There is a functional relationship which favors a preferential path from one cone to one cortical cell, but "a spreading of impulses is possible and doubtless occurs."[4]

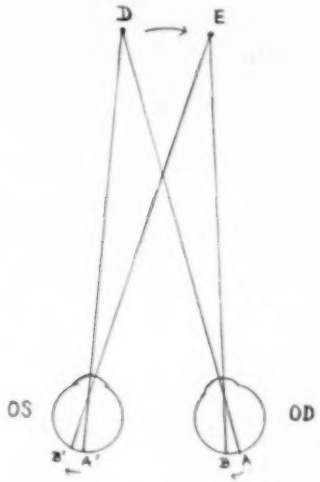

Fig. 2 (Franklin). Binocular phi phenomenon.

Impulses from a single cone have subsidiary paths which permit a spread of responses outward to several ganglion cells. Hence the visual perception (cortical) may be the same when only two retinal elements are stimulated in succession, as it is when all the intervening elements between the two endpoints are stimulated.

Contraocular phi phenomenon (fig. 3)

Both eyes are stimulated alternately at disparate points. Assuming in this case normal retinal correspondence with exophoria or divergence of the visual axes under cover: The left eye is fixating object, O, while the right eye is covered. At the instant the occluder is moved from the right eye to the left eye the image of O falls on A instead of F'. If it had fallen on F instead of F' no change in sensation would result, since F and F' are corresponding retinal points and have a common visual direction. But since A has a visual direction to the left of the point F, the sensation is one of movement of object O to the left. Since in normal binocular vision the binoculus acts as one eye, and the observer is unable to tell on which retina an image falls, the stimulation of noncorresponding points contraocularly is the same as their stimulation monocularly.

The sensation of movement occurs at the instant that the stimulus falls on a noncorresponding point of the other eye, that is, when the occluder is moved, not when the eye moves. When the uncovered eye moves in an appropriate direction to fixate the object, no movement of the image is seen. As one moves one's eyes about the environment, the various objects remain stationary, although the image of any given object must fall on various different retinal points.

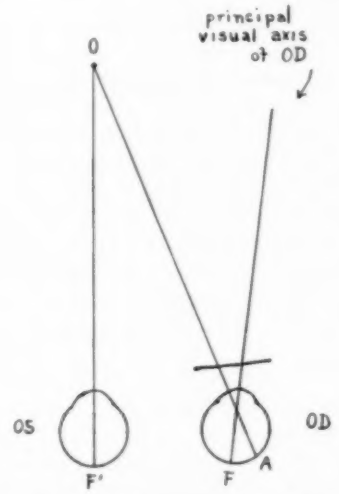

Fig. 3 (Franklin). Contraocular phi phenomenon.

The direction of projection of a retinal point is constantly modified to take into account the movements of the eye in its orbit or movement of the head and body. This is called psychologic compensation and makes it possible for the observer to recognize the directions of objects and their fixed positions in space.

It has been mentioned that, as the test is administered clinically, the eye under cover usually moves to fixate the light. This movement of the eye has no effect on the phi phenomenon as the apparent movement of the image precedes the eye movement. The phenomenon can equally well be experienced with the eyes in a stationary position. It is likewise not necessary for either eye to be fixating the light.

Returning to Figure 3, a similar diagram can be drawn to represent a case of esophoria. It can be shown in this case that the apparent movement is reversed. If a hyperphoria is present, the apparent movement is vertical. If both a lateral and vertical phoria are present, the movement of the image is diagonal.

The use of this test as an adjunct to the cover test in measuring phorias depends upon the use of prisms to place both right and left images on the foveas. The foveas being corresponding points and having a common visual direction, no movement of the test object is perceived when they are alternately stimulated. Therefore, the prisms used to stop the apparent movement of the test object measure the degree and kind of phoria present.

Abnormal retinal correspondence

The perception of movement of the test object depends upon the presence of normal retinal correspondence. Let us consider what occurs in a case of strabismus (fig. 4).

In the squinting eye, the retinal area between F, the fovea, and A, the terminus of the secondary axis, which is parallel to the principal visual axis of the other eye, is an area of indeterminate projection. This area may be referred to as the area within the angle of squint.

The image of any object fixated by the other eye falls somewhere in this area and, when not suppressed, is projected in the same direction as the principal visual axis of the other eye. As Burian has stated,[5] abnormal retinal correspondence exists when disparate retinal elements acquire a common visual direction. Referring to Figure 4, when the right eye is uncovered the image of O is found at B.

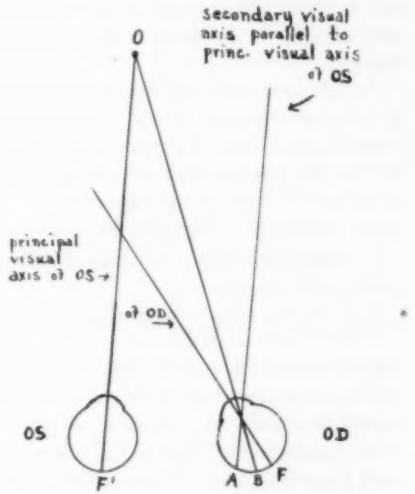

Fig. 4 (Franklin). Convergent strabismus of the right eye.

The sensorial relationship between the two retinas has been altered so that B has the same visual direction as F'. Therefore no movement of the test object is perceived when the eyes are alternately covered.

This is a binocular phenomenon, so it makes no difference which eye is covered first. The right eye may become the fixing eye, whereupon a peripheral area of the retina of the left eye becomes associated with the fovea of the right eye.

The absence of the phi phenomenon in cases of strabismus was first described by Verhoeff.[6] He observed that an object maintained its same absolute position when seen

alternately by each eye. To quote directly: "The squinter reacts as if each object in the binocular field is seen from the fixing eye only."

Chavasse[7] has expressed the same fact in another way: If two images are seen (such as one at F' and one at B), only one has proprioceptive direction, the fixing eye furnishing these data.

Verhoeff found that almost all persons with concomitant strabismus manifest this degree of abnormal correspondence, that is, that the phi phenomenon is obscured. The only exceptions are those with spontaneous diplopia.

As has long been known, the percentage of cases of abnormal retinal correspondence found depends upon the means used to detect it. The phi phenomenon test, while it gives an unusually high percentage of cases, has some advantages over any of the others:

1. It approximates conditions of ordinary vision more exactly.
2. It shows minor degrees of inhibition.
3. It differentiates between a phoria and a tropia when of small degree, the phi phenomenon being present in phoria and absent in squint.

In administering this test clinically it is well to demonstrate to the patient the monocular phi phenomenon. This can be done by having him fixate a small light while a prism is flashed before one eye (the other eye being occluded). The apparent movement of the light is toward the apex of the prism as it is placed before the eye, and toward the base as it is removed. The patient is then asked: "Do you see a similar movement of the light when you look at it with first one eye and then the other?" (The eyes are alternately occluded.) The squinter invariably replies in the negative, although he may add, "But the light is in a different place on the wall," when seen with one eye as compared to the other. What the squinter is noticing is parallactic displacement which brings us to the difference between parallax and the phi phenomenon.

Expressed in simple terms, parallax is the apparent displacement of one object relative to other objects at different distances from the observer when viewed from a slightly different position. There are two forms of parallax, motion parallax and binocular parallax.

Motion parallax

Relative displacement of objects is seen when the observer is moving. When riding on the railroad, the landscape seems to be moving past in the opposite direction. The rates of apparent movement are inversely proportional to the distance from the observer. The telegraph poles beside the track move by most rapidly while extremely distant objects are almost stationary. Motion parallax is used in moving pictures to add to the illusion of three dimensions.

One-eyed individuals may obtain the advantage of motion parallax in judging distances by moving the head from side to side. The nearer of two objects appears to move in the opposite direction to the head. This serves to separate the planes of objects which lie in the same visual direction.

Binocular parallax (fig. 5)

Figure 5 shows the right and left eyes fixating point A, while point B is at a different distance and hence not on the same horopter as A. The images of A fall on corresponding retinal points, while the images of B fall on disparate points. When the eyes fixate B, the situation is reversed. The disparity of the retinal images furnishes the means of stereoscopic perception of depth. This phenomenon is familiar to everyone and need not concern us further at this time.

In Figure 5, the drawing is simplified by placing points A and B directly in line with one eye. The same relationship would hold if A and B were placed anywhere in the visual field. However their lateral separation should not be too great. Both images should be near the macula where the visual acuity is greatest.

Definition of binocular parallax.[4] The

binocular parallax of any point is the angle subtended to it by lines from the nodal points of the eyes. Binocular parallax of point A = ∠ L A R. Binocular parallax of point B = ∠ L B R. The instantaneous parallax between two points is the difference between the angles subtended by these points. In Figure 5:

$$\angle C = \angle L A R - \angle L B R$$
$$= P D/a - P D/b$$

The smallest angle of normal stereoscopic acuity may be determined experimentally in the same way that normal visual acuity is determined. While the latter value is one minute of arc, the parallactic angle is often 30 seconds of arc or even less. By substitut-

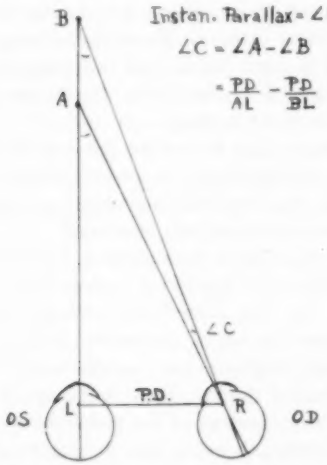

Fig. 5 (Franklin). Binocular parallax.

ing the value 30 seconds for ∠ C in the equation, a, the radius of stereoscopic vision may be calculated.[8] When point B is at infinity P D/b becomes zero and a = 400 meters or approximately 1,300 feet.

It will be noted that the parallactic angle is proportional to the pupillary distance. The pupillary distance may be increased artificially as in prism binoculars, and thus the range of stereoscopic vision is increased. It should be noted here that the phi phenomenon has nothing to do with the pupillary distance.

Of course only those with binocular single vision can be aware of instantaneous parallax. How then is the squinter aware of parallax? This is shown in Figure 6. This

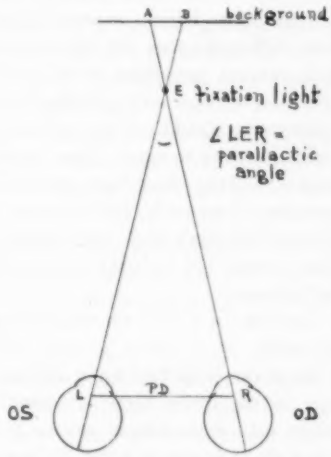

Fig. 6 (Franklin). Parallactic displacement.

might be termed successive rather than instantaneous parallax. To the right eye, E is in alignment with the background object A, while to the left eye, E is in alignment with object B. This results in apparent displacement of E relative to the background, when alternate eyes are used.

If the squinter habitually uses one eye, he relies upon motion of his head to create this parallax. If he has facility in alternation, he can simply change fixation and achieve the same effect.

It will be noted that parallactic displacement of images is present when binocular fixation and orthophoria exist, while, under these conditions, the phi phenomenon as elicited by the cover test is absent since corresponding retinal elements are being stimulated.

Parallax involves projection in space and distance from the observer. Phi phenomenon measures retinal correspondence or relative visual directions, not distances. The essence

of the phi-phenomenon test is that similar images be alternately presented to noncorresponding retinal points in the two eyes. The images may originate from the same object or from different objects, but must be sufficiently similar for the mind to accept them as manifestations of the same object. An example of the latter is seen in neon advertising where different tubes are lighted in succession to suggest movement of objects.

I have tried to show why parallax and the phi phenomenon should not be confused.

I would now like to quote from some recent books showing that these phenomena are sometimes confused. The common use of the term "parallax test" encourages but does not excuse the misstatements which frequently occur.

For example, in a text on muscle anomalies we read:

"As the cover is shifted from one eye to the other in the cover test just described, the patient with heterotropia will be forced to fixate with each eye in turn. As the eyes shift to take up fixation, the patient will note an apparent movement or 'jump' of the fixation light. This apparent movement of the fixation object is in reality due to the movement of one or the other eye in turning to a position where it may take up central fixation. Obviously enough, if the examiner has selected the correct prism, there will be no necessity for the patient's eyes to shift to fixate and consequently all movement of the fixation object as the cover is shifted from one eye to the other will appear to have ceased. The addition of the subjective observation of parallactic displacement of the fixation object to the cover test is called the screen and parallax test."

Here the author has confused the movement of the eye which the examiner observes objectively with the movement of the test object which the patient observes subjectively. The latter precedes the former and occurs independently of it. The subjective sensation is not altered if the patient is told to hold his eyes perfectly still. The sensation of movement is due to the alternate stimulation of disparate retinal elements, which normally have different visual directions. The actual movement of the eye to change fixation produces no movement of the image, as is amply demonstrated in everyday life as we move our eyes constantly about our environment and yet perceive objects in their fixed positions in space.

In another text where the parallax test is described this statement occurs:

"Direct the patient to state whether the light that he fixes at 6 M. moves or remains stationary while the card is shifted from one eye to the other during the cover test. If the light moves the images are not seen simultaneously (binocular single vision) but one after the other. Binocular single vision is vision which is performed by fixation with the fovea of each eye. Normally an image is formed at each fovea and the images are superimposed by the fusion faculty so that only one object is seen.

"Measure and record the amount of parallactic displacement by prisms placed before the eyes until the test object no longer appears (to the patient) to move."

The explanation here given as to why the light moves is somewhat ambiguous. The images are not seen simultaneously since they are alternately presented. Neither is binocular single vision possible under the conditions of the test. These facts do not explain the movement of the test light. If the authors mean to imply that the patient does not have potential binocular single vision, they are mistaken, as it is exactly those patients who do see the movement.

In both quotations the examiner is supposed to be measuring "parallatic displacement." Parallactic displacement does not enter into this test if properly administered, and if there is parallactic displacement between the fixation light and its background, prisms will not eliminate it. Parallax is inherent in the lateral separation of the two eyes and is not dependent upon the presence of strabismus or heterophoria.

A third illustration from current literature is this sentence:

"If there is heterophoria an apparent movement of the target will take place as the non-fixating eye assumes the fixating position when the cover is shifted to the other eye."

Actually the apparent movement takes place before the nonfixating eye assumes the fixating position.

The prism displacement test

In studying amblyopia and strabismus, Irvine considered utilizing the phi phenomenon to determine the degree of inhibition and type of retinal projection in the squinting eye. In order to stimulate certain selected retinal areas, a prism was moved rapidly before the amblyopic eye, while the other eye maintained fixation on a light or other suitable test object. The prism produced a second image in the area desired, and its position relative to the fixation point (foveal projection of the other eye) determined the retinal correspondence. Thus was developed the prism displacement test.[9] This method was used extensively in his recent research on amblyopia ex anopsia.[10]

Summary

The phi phenomenon is the sensation of movement which occurs when disparate retinal elements are successively stimulated. When normal retinal correspondence is present, the phi phenomenon may be elicited by stimulating each eye alternately at disparate retinal points.

In the majority of cases of strabismus the contraocular phi phenomenon is absent because some degree of abnormal retinal correspondence has developed as an adaptation to the strabismus. Disparate retinal elements have acquired a common visual direction, therefore their alternate stimulation produces no sensation of movement of the image.

The clinical use of the phi phenomenon is described for (1) measurement of heterophoria and (2) detection of a minimal degree of strabismus.

Motion parallax, binocular parallax, and parallactic displacement are described. Binocular parallax results from the lateral separation of the two eyes, is proportional to the pupillary distance, and inversely proportional to the distance of the object of regard. Upon this depends the stereoscopic perception of depth.

The distinction between the phi phenomenon and parallax is stressed. Quotations from recent ophthalmic literature demonstrate current misconceptions regarding these two phenomena of binocular vision.

It is unfortunate that the name "parallax test" is applied to what should be designated as the phi phenomenon. If the latter term appears somewhat unwieldy, the term "subjective cover test" would be preferable to parallax. It is descriptive of the method and suggests that the effect observed is due to the deviation of an eye under cover. The only objection to this term is the implication that the sensation of movement is due to the movement of the uncovered eye as it resumes fixation. That this is a false assumption has been demonstrated in this paper.

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Discussion

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In 1940, I asked Miss Franklin to discuss Dr. Verhoeff's article on strabismus and the phi phenomenon before a local society. I am sure you will agree that her lucid explanation of the phi phenomenon and its differentiation from parallax should have been published then, for subsequent confusion in the literature might have been avoided. When your president asked me to talk about amblyopia, it seemed appropriate that Miss Franklin should first describe adequately the phi phenomenon, for it was her interpretation of this that led me to consider utilization of the phi phenomenon to study the area of the retina adjoining the fovea in amblyopia.

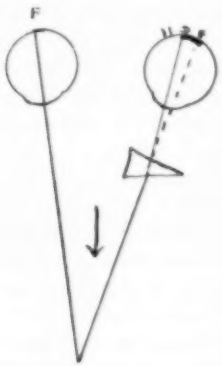

Fig. 1 (Irvine). Prism displacement test. Five-diopter prism moved momentarily in front of amblyopic eye. Diplopia may or may not be seen depending upon the intensity of suppression in area, D F. There is no movement of the eyes since the dominant eye is fixing.

I reasoned this way: In amblyopia ex anopsia, without apparent strabismus or anisometropia, a condition which frequently had to be distinguished from malingering in army clinics, strabismus may have been present at some time and the sensorium of the retina involved in the angle of squint may have been conditioned to inhibit recognition of the phi phenomenon; whereas, in cases of amblyopia resulting from a minute organic lesion without strabismus there would have been no reason for the retina to become conditioned to project abnormally in the area near the macula, and the phi phenomenon should be present.

This concept proved to be only partially correct. With relatively recent organic lesions the adjacent uninvolved retina reacted normally while in long-standing lesions inhibition factors did alter the response.

At first I tried to set up an apparatus that would allow stimulation of the retina of the amblyopic eye in various areas with alternate flashing lights, but this proved impractical. I then conceived the idea of simply interposing a prism momentarily in front of one eye while the other eye was fixing a small muscle light or a spot on a tangent screen. The position of the second image could be altered by changing the position of the prism. Thus was developed the prism displacement test which I consider a useful adjunct to other methods of studying the sensory aspects of strabismus.

As diagrammed in Figure 1, when the prism is passed in front of the amblyopic or nondominant eye, the patient may see two lights or not, depending on the degree and site of the inhibition present and the position in which the prism is held. The inhibition is on the side of the macula involved in the angle of squint, past or present; that is, on the nasal side of the macula in esotropia, temporal in exotropia, and above or below in vertical tropia. The patient will report that he sees one or two images with the prism in one or all positions, but the eyes do not move when the prism is passed before the amblyopic eye as the dominant eye is maintaining fixation.

When the prism is passed in front of the dominant fixing eye, as diagrammed in Figure 2, the patient usually reports no diplopia. Instead he sees the original image moving in the direction of the apex of the prism (monocular phi phenomenon). At the same time, the examiner observes that the eyes have both moved, the dominant eye to take up fixation of the test object, the other eye making the appropriate conjugate movement. The second image from the amblyopic eye is usually not seen. If seen, it is localized anomalously in the direction of the base of the prism. This is because the dominant eye alone has direction sense, and the image of the other eye is related to the image of the dominant eye.

If there is binocular vision or bifixation with no difference in the relative inhibition

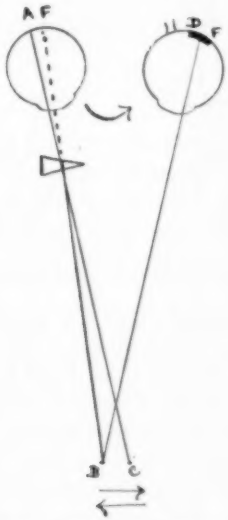

Fig. 2 (Irvine). Prism over dominant eye. No diplopia can be seen. Instead movement of B to C and conjugate movement of the eyes are noted.

of the two eyes, as in the normal situation (fig. 3), the patient will see two images with the prism passed in front of either eye, in any position, and there will be no movement of the eyes, as the eye without the prism usually maintains fixation. If the eyes are equally dominant, the stationary image retains its direction relative to the observer, and the new image is projected relative to the stationary one.

In binocular vision the response is the

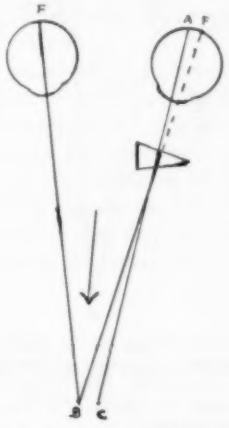

Fig. 3 (Irvine). Binocular vision. Prism over either eye causes diplopia. There is no conjugate movement as opposite eye maintains fixation.

same, both as to diplopia and movement of the eyes over whichever eye the prism is flashed; whereas, in amblyopia or strabismus, where there is a definite difference in ocular dominance, the response is always different for the two eyes.

The test then determines the presence or absence of bifixation and the presence or absence of ocular dominance. In addition, the site and degree of retinal inhibition can be established by varying the position of the prism and the interest value of the spot relative to the background. When prisms of varying strengths are used, the extent of retinal inhibition can be judged by the response obtained and scotomas of various sizes can be mapped out.

The type and accuracy of retinal projection can be estimated from the site of projection of the image displaced by the prism. Figure 4 attempts to diagram how considera-

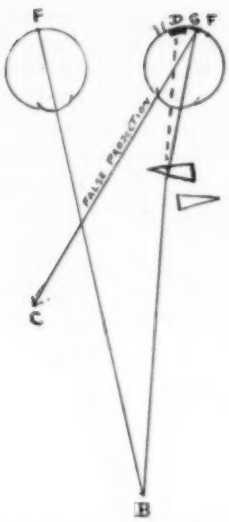

Fig. 4 (Irvine). Prism test in strabismus. Measures site, degree, and extent of retinal inhibition and retinal projection. (D) Suppression area, scotoma at angle of squint. (G) Area of indefinite or false projection.

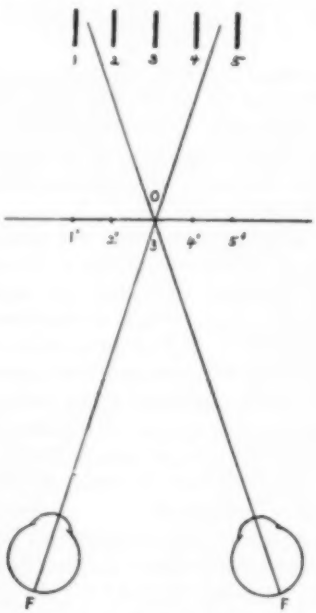

Fig. 5 (Irvine). Parallax.

tion of the phi phenomenon led to a simple method for determining retinal inhibition, scotoma, and projection.

To reëmphasize the difference between the phi phenomenon and parallax, I would like to show two more diagrams which Miss Franklin made for me and did not include in her paper.

In Figure 5, if both eyes are fixing an object O, behind which is a screen marked with stripes, 1, 2, 3, 4, and 5, the right eye projects O between 1 and 2 and the left eye projects O between 4 and 5. If orthophoria is present and the eyes are alternately covered, as in the cover test, the patient, seeing the object in different positions relative to the background may interpret O as having moved, although actual movement is not seen. This apparent displacement is parallax and not the phi phenomenon, corresponding points F and F being stimulated.

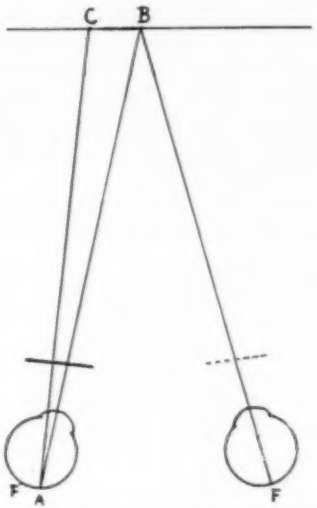

Fig. 6 (Irvine). Phoria (phi phenomenon).

Now if the screen is moved forward to the plane of O no movement of the object is seen as corresponding points F and F are stimulated and parallax has been eliminated.

However, in the presence of a phoria,

under similar testing conditions (fig. 6), when the cover is changed from the left eye to the right eye, the image falls on noncorresponding point A, which is projected to C, giving the impression that B has moved to C. This is the phi phenomenon, not parallax, the background having no influence on the interpretation of position or movement.

If strabismus is present, instead of phoria, and this test is repeated, the patient will not see the movement of B to C, as Miss Franklin has brought out. The test then can be used to distinguish between a phoria and a tropia, but in doing the test the examiner must be careful to maintain conditions that eliminate background factors in order to interpret the patient's response correctly. One cannot demonstrate the difference between the normal and abnormal responses in this test by holding a flashlight in front of alternately covered eyes, as is usually done in the cover test, but instead must have the patient fix an object on a plain screen, eliminating from view surrounding and background objects.

The subjective cover test is frequently used by all of us doing muscle work. I am sure we are grateful to Miss Franklin for having explained the test to us in a way that insures proper interpretation of results. No doubt her clear explanation will correct any misunderstanding that may prevail.

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ELIMINATING DISTORTION DUE TO PRISMS IN GLASSES*

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McFarland,[1] in 1883, described the results on himself of wearing glasses with 16 prism diopters base-in before each eye. The glasses enabled him to overcome his exotropia, and obtain stereopsis while doing surgery, so he wore them part time for 17 years. Luhr,[2] 1931, reported the case of a girl, aged 13 years, who wore from 22 to 34 prism diopters of vertical prism divided between the eyes for three years with relief of diplopia.

Most writers object to the use of strong prisms because of distortion, defective space perception, and discomfort (Green,[3] 1918; Eggers,[4] 1933; Olsho,[5] 1934 to 1939; Dean,[6] 1939). Recent work suggests that base-out prisms may make esophoria worse.

Guibor,[7] 1943, is one of few who prescribes higher prism powers. His patients wear prisms as great as 14 prism diopters base-out before one eye. In children, he has used temporary prisms as high as 40 prism diopters divided between the eyes to "stimulate fusion." He said, "The patient must suppress the asymmetry of objects and metamorphopsia produced by the prisms and will develop good fusion as the ocular deviation improves."

Hardy,[8] 1945, wrote on the clinical use of prisms. Some of his conclusions are illustrated in Figure 1. Hartinger,[9] 1927, examined plane-surfaced prisms from a mathematical point of view, comparing various formulas for finding maximum and minimum deviation. Figure 2 was derived from his tables. He observed that prisms stronger than five prism diopters before each eye decreased stereopsis, and that the distortion from prisms is greater for near than for distance.

Prentice,[10] 1891, changed the calibration of prisms to prism diopters. He objected to the apex angle as inexact, since glass might be of different refractive index. He found

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prisms identified by minimum deviation too tedious for calculation and lens design. He specified that to measure the prism diopters in a prism, it should be placed near the eye, the upper edge near the apex splitting the pupil, so that one eye sees two images on the tangent scale six meters away. Distortion of images seen through a prism is greater for near targets. At one meter, the deviation of a 20-prism-diopter prism is 17.9 near the base and 18.9 near the apex when tested as described. At six meters the difference is 0.5 prism diopters.

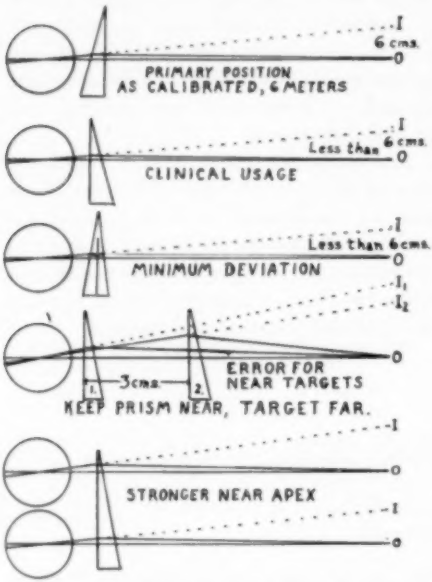

Fig. 1 (Miles). Illustrating the primary or calibration position, the position in common use, minimum deviation, and errors of distance. With incidence constant, a prism is strongest near its apex.

The prism diopter, unfortunately, is a unit which cannot be added or subtracted. One centimeter deflection of an object along a tangent subtends a greater angle than the difference between 10 and 11 centimeters. The degree and the centrad are superior on this count. To reduce prism diopters to degrees, divide by 100, and the result is the tangent to the angle desired. The tangent of five degrees in the trigonometry tables is 0.08749. Setting the decimal two digits to the right gives 8.749 prism diopters.

Wadsworth,[11] 1879 and 1883, first noted the sensation of the curvature of plane frontal surfaces produced by binocular prisms base-in or base-out before the eyes. He explained that one of a pair of corresponding rays was bent with greater deviation through the prism apex while the other underwent less deviation through the base. He made no mention of the type of distortion found in Figures 3 and 4.

Lippincott,[12] 1917, explained the same phenomenon on the basis of curved vertical lines and their disparity in stereopsis. This type of distortion is explained in Figure 3.

In Figure 5, base-out prisms make the vertical lines bulge toward the base of each prism so that, binocularly, the ends of the lines (part 2) are seen in crossed disparity, and the centers in uncrossed. The fused result is perceived (part 3) as curved with the center away from the eyes. Oddly enough, this second type of distortion in prisms complements and intensifies the other described by Wadsworth. (See, also, Figure 7 and explanation given later.)

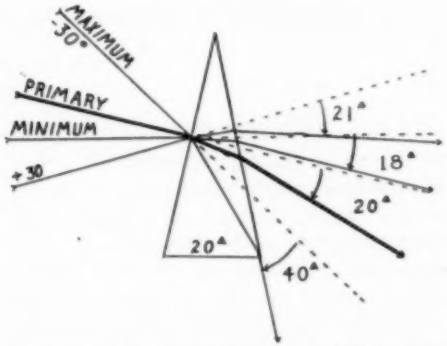

Fig. 2 (Miles). Illustrating the variable power of a prism with incident ray plus or minus 30 degrees from the primary.

Lippincott philosophized on the possibility of adaptation to distortion, and the possibility of changing of the corresponding points

in the two retinas. He concluded, as does modern Gestalt psychology, that correspondence is subject to change. This matter is not settled. Experience in measuring aniseikonia over periods of years tends to indicate a stable correspondence. The shape of the horopter at different fixation distances undergoes variations that can only be explained by fixed directional values of individual retinal elements.

Whether distortion alone can cause ocular discomfort is questionable. If distortion is different in the two eyes, it would certainly introduce disparity of the two retinal images, causing imperfect fusion and faulty space perception. Eliminating the distortion from prisms has never, to my knowledge, been tried clinically, and would seem to be a preliminary step to any clinical evaluation of the use of prisms in the treatment of muscular anomalies.

Figures 3, 4, and 5 explain the first type of distortion which causes target lines parallel to the prism base to appear curved. Figures 6 and 7 explain the effect of an object having several parts on a line perpendicular to the prism base due to differences in magnification at the apex and base. Although, in plane prisms, there is never deflection of any ray except in a plane perpendicular to the base, there may be a difference in the base

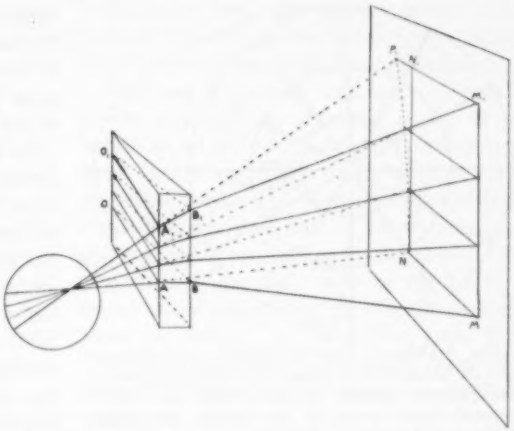

Fig. 3 (Miles). How a plane-surfaced prism makes a straight line appear curved. The effective prism, ABO, gets thicker A_1B_1 up toward M_1.

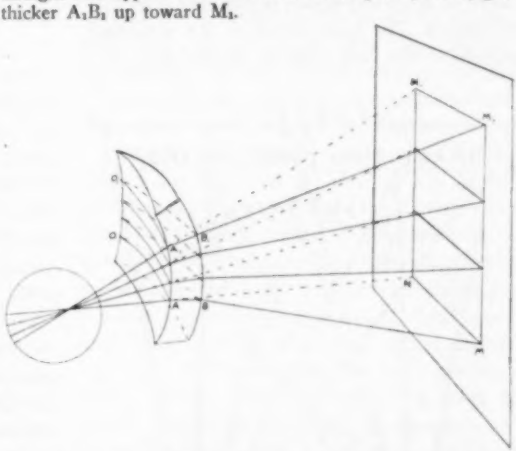

Fig. 4 (Miles). When a prism is curved, distortion of target contours parallel to the prism base is reduced. AB equals A_1B_1, so that the deflection MN is equal to M_1N_1.

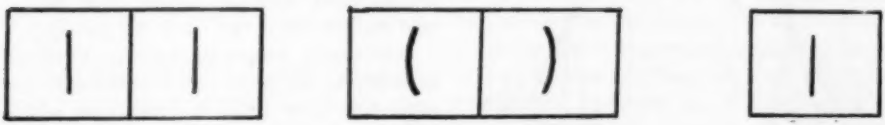

Fig. 5 (Miles). Due to uncrossed disparity in the center and crossed at the ends of the vertical line targets, the fused image is seen curved away from the eyes with base-out prisms. With base-in prisms the opposite occurs. This distortion can be eliminated by deep base curves. Large patterns, as in Figure 6, appear concave or convex when viewed binocularly in a similar way.

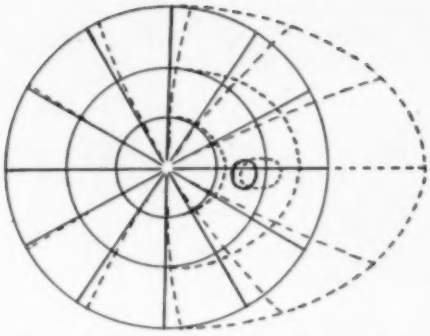

Fig. 6 (Miles). The asymmetrical magnification of a 20-prism-diopter prism with plane surfaces in the primary position 13 mm. from the cornea, tangent-screen target at one meter, apex right. (Object and image are superimposed.)

curve of a curved prism in the two principal meridians. The base curve in the meridian parallel to the base corrects the bending of a single straight line parallel to the base, while the base curve in the meridian perpendicular to the base corrects the unequal spacing of parts of an object along a line perpendicular to the base.

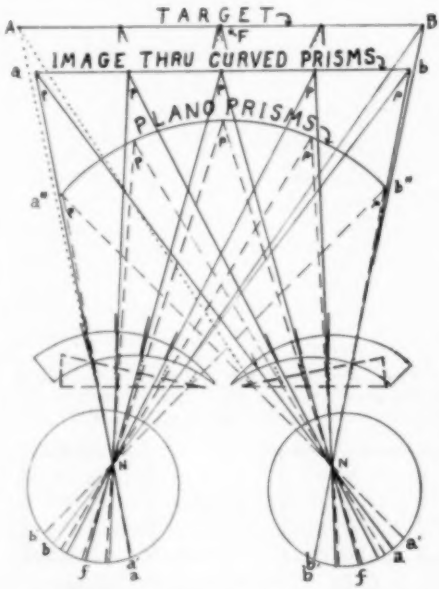

Fig. 7 (Miles). Diagram to show how distortion is greatly diminished by prisms on deep curves (solid lines) where nearly minimum deviation occurs in all parts of the prism. Base-out prisms make the plane target appear concave. Base-in prisms would have the opposite effect.

In Figure 3, the solid lines represent the actual rays, and the broken lines the projected rays. The ray at AB undergoes minimum deviation, so the projected image falls short at N. The oblique ray, A_1B_1, passes through more glass, so the effective prism, $A_1O_1B_1$, has a wider base. Therefore, the straight MM_1 is perceived curved, NP_1. A line perpendicular to the prism base is not curved, but points on it are disarranged by the second type of distortion (figs. 6 and 7). Lancaster,[13] 1948, published an explanation of this latter type of distortion.

Correcting the distortion

The first experiments with corrected prisms were made by Ames,[14] 1932, who put the prism faces on a deep base curve. A prism of three prism diopters required a −9.0D. sph. rear curve. Ogle, with Ames, made calculations, lens bench, and subjective horopter tests on prisms of various curves and prism powers. They were aware of the type of distortion in both meridians.

Figure 7 shows the effect of plane and curved prisms on the apparent position in space of a geometric pattern arranged in the frontal plane before the two eyes. Fixation remains on the central one, F, of five points on the horizontal target line, AB. The actual rays are not all drawn. The solid lines represent the projected rays when curved prisms are involved, and the broken lines represent the projected rays with flat prisms.

Binocularly, images in space are localized in depth by the point of intersection of the projection lines from the two eyes which originate in the two retinal points stimulated by the one image point. Point A at the left end of the target, AB, stimulates point, a′, in the right eye and a′ in the left eye.

In plano prisms, disparity is produced. Apical rays through the plane prisms are

projected at a greater angle than rays arising from the same target point falling through the base of the opposite prism before the other eye. The distance between the fovea, f, and the retinal point stimulated, a′, in the left eye is less than that between f and a′ in the right eye. This is crossed disparity, which localizes the point, A, on the target at a much nearer point, a″. All rays converging on the points, p, are projected rays. Those rays partially illustrated converging on the points of the line, AB, are the actual rays. If the diagram were sufficiently accurate, it would show asymmetrical spacing of the broken lines at the retinas.

It is evident that distortion in prisms is not a simple function. Deviation of a ray from the nodal point of the eye is constantly increased as the ray rotates from the base of a plane prism to the apex. The effect can be seen in Figure 6 in a strong prism.

A weak glass prism placed 12 mm. from the cornea caused variable bending of rays through the nodal point such that the apical ray measured 4.0 prism diopters, the central ray 2.84, and the basal ray 2.43. When the same prism was constructed on a base curve of 7.0 diopters, the apical ray measured 3.20 prism diopters, the central ray 3.16, and the basal ray 3.03.

This correcting effect is very sensitive to dioptric curves, vertex distance, power of the prism desired, effective dioptric power of the two curved surfaces, but especially to the thickness of the prism itself. A change in thickness of 0.5 mm. may affect the balance of apical and basal prism power by 25 percent. A change in tilt of the prism with respect to the visual axis will likewise upset the balance.

Since the eyes do not remain in a fixed position with respect to spectacle lenses, the correction of the distortion due to prisms in glasses can never be perfect in all directions of gaze. Nevertheless, attempts should be made to reduce distortion to a minimum in the directions of gaze in common use.

Distortion may be defined as that characteristic of a lens which causes variation in distance between points in the image plane which in the object plane are equidistant.

For present purposes distortion is defined as the difference in prismatic power of a prism placed before a fixed eye in apical and basal rays through the nodal point of the eye, 30 degrees above and 30 degrees below the visual line, perpendicular to the prism base; and the difference in length of the part of rays through the nodal point of the eye internal to the prism along the visual axis and along the oblique ray, 30 degrees from the visual axis parallel to the prism base. A study of Figures 4 and 7 should clarify this concept.

The figures tabulated in this paper came from ray diagrams made three or four times natural size. The distance between the cornea and nodal point was made eight mm., the vertex distance between cornea and rear surface of prism 12 mm., and the two prism surfaces were placed symmetrically to the visual axis.

Correcting the distortion due to the difference in the length of the internal ray in the meridian parallel to the base (fig. 4) was comparatively simple. Ray diagrams were constructed with afocal combinations of spherical surfaces of such thickness required to produce a given prismatic power. After several trials, a combination was found giving equal internal ray lengths. The front surface, being further from the eye, must have a weaker power than the rear, to introduce as little spherical power as possible. The results are given in Table 1.

The thickness of the prism base given is the length of the internal ray on the visual line, and 30 degrees oblique. The thickness of the prism apex given was determined secondarily by further ray diagrams in the opposite meridian to be described. In the meridian perpendicular to the prism base, the apical and basal thicknesses given refer to the length of the actual ray internal to the prism, 30 degrees apical and 30 degrees basal to the visual line.

Correcting the distortion in the meridian

TABLE 1

CORRECTING DISTORTION IN THE MERIDIAN PARALLEL TO THE BASE (fig. 4)

Prism Power (diopters)	Front Curve (diopters)	Rear Curve (diopters)	Apex Thickness (mm.)	Base Thickness (mm.)
0.5	+8.00	−8.00	1.0	1.1
1.0	+8.00	−8.00	1.1	1.6
2.0	+8.00	−8.00	1.2	2.2
3.0	+8.00	−8.00	1.3	2.7
5.0	+8.00	−8.00	1.4	3.7
8.0	+8.00	−8.00	1.6	5.3
12.0	+8.00	−8.50	1.9	7.5
16.0	+8.25	−9.00	2.2	9.5
20.0	+8.50	−9.50	2.4	11.8
25.0	+8.62	−10.00	2.7	14.3
30.0	+9.00	−11.00	2.9	17.0

perpendicular to the prism base is more difficult because of the great change in prism power introduced by slight change in overall thickness of the prism. Formulas exist describing accurately the lens characteristics required for minimum distortion and for describing the curvatures of images formed through prisms (private communication from K. N. Ogle) but I am not mathematician enough to understand them. (Other ophthalmologists may find it easier to follow ray diagrams, also.) In my opinion, lacking higher accuracy, the results tabulated in this paper for the curves in the two meridians are sufficiently superior to prisms already in use to make clinical trial immediately possible.

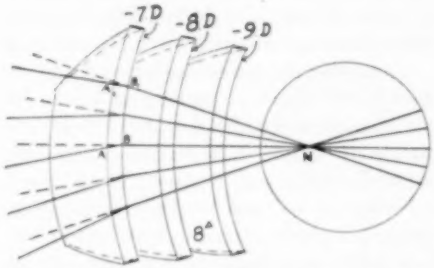

Fig. 8 (Miles). In a prism curved to make A_1B_1 equal to AB, the dioptric power of the rear surface varies with the vertex distance approximately as illustrated. Vertex distances are 15, 12, and 9.0 mm.

Table 2 shows the dioptric power of each surface in the meridian perpendicular to the base, that is, in the apex-base meridian (fig. 7). Here, the prism diopter bending of the apical, the central, and the basal ray was directly measured as 100 times the tangent (in a right-angled triangle, the opposite side divided by the adjacent side, not the hypotenuse, is the tangent of an angle).

There is a slight error, here, in that the distortion of a prism is greater for near than

TABLE 2

CORRECTING DISTORTION IN THE APEX-BASE MERIDIAN

Prism Power (diopters)	Front Curve (diopters)	Rear Curve (diopters)	Prism Diopters Approximate 30°		
			Apical	Central	Basal
0.5	+8.00	−8.00	0.60	0.49	0.50
1.0	+8.00	−8.00	1.2	1.0	1.05
2.0	+8.00	−8.00	2.14	1.85	1.92
3.0	+7.00	−7.00	3.20	3.16	3.03
5.0	+7.00	−7.00	5.30	5.34	5.40
8.0	+6.00	−6.00	8.14	7.50	7.80
12.0	+6.00	−6.00	12.4	11.2	12.4
16.0	+5.90	−6.00	16.0	15.5	15.9
20.0	+5.85	−6.00	20.4	19.7	20.6
25.0	+5.80	−6.00	25.0	23.3	24.8
30.0	+5.75	−6.00	29.9	29.2	29.6

for distance. If the distance between the nodal point and the equivalent point (analogous to the principal plane) where the ray is bent could be kept equal, distortion would be equal for near and distance. This error is allied to that due to effectivity of lenses, in that the prismatic power of a thin prism depends on the distance from the nodal point. The prism loses strength as it is pushed away from the eye. In all of my ray diagrams, the "principal plane" in which the ray is bent appeared one centimeter or so more remote from the nodal point basally compared to apically. This error was ignored, being less important than errors of construction.

Figure 8 shows the approximate variation in the base curve of an eight prism-diopter lens when the vertex distance is varied between 15 mm. and 9.0 mm. For all changes in dioptric power required in individual patients, the curves correcting distortion due to prism to be incorporated in glasses must be altered. In minus lenses stronger than 1.5D., the design becomes more complex, requiring doublet lenses. Naturally, such lenses will be expensive, but not necessarily more so than iseikonic lenses.

Summary and Conclusions

It might prove a useful measure for treatment of concomitant phoria or moderate tropia if strong prisms in glasses could be worn comfortably without metamorphopsia. Eliminating all distortion possible would seem to be a preliminary step to any clinical use of prisms in glasses.

Two causes of distortion in prisms are explained and described, with methods of correction by certain base curves in the two principal meridians of the prism.

Orthoptic, stereoscopic, or other instruments in which prisms must be used should be made distortion-free. In use, the vertex distances should then be carefully controlled.

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VENOUS ANEURYSMS OF THE ORBIT*

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Significant alterations in the orbital veins, whether congenital or the results of pathologic degeneration of the vascular walls, neoplasm, or trauma, give rise to venous aneurysms. Arteriovenous aneurysms within the cavernous sinus follow basal fractures with laceration of the carotid artery. The progressive exophthalmos and the bruit which follows is an easily recognized clinical syndrome. Such aneurysms also follow penetrating injury of the orbit and may occur spontaneously without any known cause.

Venous aneurysms without direct arterial connection are of two types: (1) Those giving rise to intermittent exophthalmos and (2) those causing progressive or recurrent exophthalmos. Proptosis sometimes appears or increases only when the head is bent forward or when the jugular veins are compressed retarding the return of venous blood from the head. Parsons[1] used the term "intermittent exophthalmos" for this type of temporary exophthalmos which disappears or is replaced by enophthalmos when the cause of the increased venous pressure is no longer active.

Venous tumors of the orbit also produce exophthalmos that is permanent or progressive in contrast to the intermittent exophthalmos of simple aneurysm.

In some cases exophthalmos is variable in extent and is accompanied by recurring increase in proptosis associated with ecchymosis of the lids and conjunctiva. Such episodes are caused by thrombosis within the aneurysm and are of considerable diagnostic significance.

The pathogenesis of intermittent exophthalmos was reviewed by Parsons, and the theory of Birch-Hirschfeld was held to be the most acceptable. This theory suggests filling and dilatation of orbital veins by partial or complete blockage of the communication of these veins with the jugular vein by way of the angular and facial veins.

Walsh and Dandy[2] recently reviewed the literature on intermittent exophthalmos and stated that Krauss considered large congenital varicosities in the orbit associated with an obstruction of the outflow of blood from the orbit, either anteriorly or posteriorly, to be a possible cause.

Krauss noted a pronounced constriction of the superior ophthalmic vein in the region of the superior oblique muscle, and both Birch-Hirschfeld and Krauss remarked on the narrowing of the ophthalmic vein near its entrance into the cavernous sinus.

However, Walsh and Dandy felt that an obstruction within the veins could not explain intermittent exophthalmos, because proptosis appeared promptly with jugular compression which would show that obstruction was not present in the venous channels.

Permanent proptosis owing to venous angioma may be explained on the basis of increased orbital contents as the tumor itself increases in size just as in cases of other types of orbital tumors.

The cause of recurrent proptosis has been found to be thrombosis of varicosities in the orbit, which may take the form of sacculated aneurysms or spongy cavernous tumors. Thrombi form and give rise to acute inflammation associated with pain, swelling, and proptosis. Discoloration of the lids is a diagnostic sign and indicates whether or not there has been bleeding into the orbital tissues.[3]

Posey[4] noted that this condition was accompanied by marked constitutional symptoms such as nausea, vomiting, dizziness, and, at times, coma. He stated that the movements of the globe were painful and restricted.

* From the Mayo Foundation and the Mayo Clinic.

The general term for a tumor of the blood vessels is "hemangioma." The varieties are distinguished according to the size and type of the blood vessels; however, a vascular tumor in which veins are the essential element is called a "venous aneurysm."

A tumor with endothelial-lined blood spaces separated by stroma is a cavernous type of hemangioma, and the stroma of connective tissue may be present in any proportion so that the term "fibro-angioma" is sometimes applicable.[5]

Fibro-angiomas occur in the orbit in two forms, encapsulated and diffuse. The encapsulated form is a firm, discrete mass that is slow growing and that produces exophthalmos if large enough. The diffuse type has a thin distensible capsule with thin septa throughout the mass of vessels forming spaces which increase in size when venous pressure is increased. Bruit and thrill are absent but a pulsation may be elicited by applying mild pressure. At operation these tumors often collapse and are difficult to find.[6]

Virchow ascribed hemangiomas to slight irritation of highly vascular free edges and surfaces, while Parsons stated the belief that possibly they are always congenital;[7] Duke-Elder described them as developmental in origin, the predisposing condition being present at birth and the angioma developing gradually, often being observed in young people.[8]

Report of Cases

Case 1. A 19-year-old white girl, first seen at the Mayo Clinic in November, 1939, had noticed that for the past three years proptosis of the right eye developed when she stooped. The eye would go back into place when she stood erect and she could hasten the process by pushing on the eye. For a few months previous to her admission, proptosis had become more marked. She never felt any pulsation about the eye even when it was out of place.

Vision was 6/6 in each eye. When standing, the reading according to the exophthalmometer was 15 mm. for both eyes. After holding the head down, however, the right eye would protrude but neither pulsation nor bruit was present. The right fundus was normal as was also the left eye. Roentgenograms showed evidence of a small rounded calcification within the right orbit near the lateral wall. General examination revealed no other abnormalities.

A right transfrontal flap as is used for chiasmal lesions was turned down, and, when the dura was elevated from the roof of the right orbit, a blue discoloration was noted in the middle and outer thirds. After removal of the roof of the orbit, the periorbita was incised and an angioma was found adherent to it.

In an attempt to free the angioma it was ruptured, and sharp venous bleeding occurred. Only small bits of the angioma were removed, and the electrosurgical unit and a fairly large pledget of muscle were necessary to control the bleeding.

After operation the vision of the right eye was 6/12. The palpebral fissure was slightly narrower and the right superior rectus muscle was weak.

Letters from the referring ophthalmologist in 1944 and 1947 stated that the patient still had protrusion of the right eye on bending over but the eye was normal in other respects. Further operative measures had not been performed.[4, 9]

Case 2. A white woman, aged 34 years, was first seen at the clinic March 22, 1945. She complained of proptosis of the right eye when she stooped or lay on her right side. About 10 months previously she had noted a small swelling medially above the right eye and proptosis on bending over sometimes accompanied by a sharp pain over the right eye.

The right upper lid appeared full and readings by the exophthalmometer were 17 mm. for the right eye and 16 mm. for the left eye. When the patient bent forward, the tissue of the right orbit bulged, especially beneath the superior orbital rim. This receded when the patient sat erect. A tumor could not be palpated or a bruit heard. Results of general examination and examination of the ears, nose, and throat were normal as were roentgenograms of the sinus. Treatment was not advised.

A letter from the patient on October 24, 1949, stated that the right eye still protruded when she stooped, about the same amount as in 1945, and it did not protrude when she stood. She had never noted any discoloration of the lids and the vision had remained good.

Case 3. A white child, aged seven years, was seen at the clinic in 1923. His left eye had protruded from the orbit since birth. The eye was held in place with a bandage during the first year of life; coughing, crying, and bending forward caused marked proptosis. At times the eyeball had been completely dislocated forward between the lids. The vision in the left eye had always been poor and a roentgenogram taken when the patient was three weeks old showed evidence of a coloboma in the frontal bone over the left eye.

While the child was watching a motion picture, a pulsation in the eye suddenly developed accompanied by pain. This occurred shortly before the patient was seen at the clinic and a bandage had been worn to keep the eye in place. On removal of the bandage, the left eye protruded and pulsated with

considerable pain. The upper lid was discolored and cyanotic. Palpation over the left frontal region showed lack of bone. The retinal veins were engorged, but the fundus was otherwise normal. The right eye was normal with vision of 6/12.

Surgical intervention was advised, but treatment was refused by the parents.

Additional data on the case have been obtained from doctors who have seen this patient. Newton[9] reported moderate intermittent convergence with limitation of lateral rotation of this eye to slightly beyond the midline. He measured maximal proptosis of 24 mm. and was able to push the eye 10 mm. farther into the orbit than the right eye. He was able to measure the vision in the left eye as 1/10. His roentgenograms showed the anterior opening of the left orbit to be about one and a half times the size of that of the right and the depth about a third greater. In 1944, Newton wrote that the condition of the eye had remained practically unchanged during an interval of 20 years. In 1941 the vision was 20/200.

Case 4. A white boy, 23 months of age, was brought to the clinic on May 8, 1944, because of sudden proptosis of the left eye which occurred one week before the patient's admission and had not regressed. The child may have had a mild bump on the cheek before proptosis developed. He was born with a fibrolipoma on the left frontal area. This was removed at the age of 17 months and at that time roentgenograms of the sinuses and frontal bones were normal.

Examination showed the right eye to be normal but proptosis of the left measured approximately 10 mm., and a mass could be felt in the orbit between the eyeball and supratemporal orbital rim. The bulbar conjunctiva was congested, but the cornea was clear. The left fundus was not seen clearly but gross lesions were not present.

On May 11, 1944, surgical removal of the tumor was attempted through an incision along the supratemporal rim of the orbit but when the periorbita was depressed and the orbit explored, a mass could not be felt. By going down through the tissue beneath the lacrimal gland, a large venous cirsoid aneurysm was uncovered. This must have been partially thrombosed because, when it was opened, considerable serosanguineous fluid escaped and the mass collapsed. The mass was removed with slight hemorrhage.

After the operation the condition of the eye improved and in one month the eye was in normal position. The patient was given a series of roentgen-ray treatments elsewhere.

The patient did well until the spring of 1948 when he had measles; the eye again protruded for a few days, but it regressed spontaneously. He remained well until September when a respiratory infection developed and the left eye rapidly protruded again.

Examination of the boy at the age of six years showed the right eye to be normal with 6/6 vision. The left eye was proptosed 10 mm. and displaced downward about 1.0 cm. The vision was 6/10+, and the lids and conjunctiva were edematous. The left optic disc was normal but all the venules were dilated to about twice their normal size; the arterioles were normal.

On September 30, 1948, an incision was made along the superior rim of the left orbit, and on the nasal side of the orbit was a twisted venous aneurysm about 1.5 by 2.0 cm. in size. In an attempt to remove it, the wall was nicked and several cubic centimeters of black fluid escaped; the walls collapsed and could not be identified but were partially removed.

The patient recovered from the operation having a persistent soft swelling in the left supraorbital region, and the lids could not be opened fully. On May 22, 1949, the left eye again protruded and the upper lid became ecchymotic; proptosis however, started to subside within two days. When examined on May 26th, proptosis of the left eye measured 7.0 mm. and the conjunctiva and fundus were normal. The patient continued to improve and received no other treatment.

Case 5. A white girl, eight years of age, was brought to the clinic because of redness of the left eye, swollen and purple lids, and protrusion of the left eye, all of which developed about three weeks previously. The amount of proptosis had remained constant.

The parents felt that the child had had slight prominence of the left eye since birth. At the age of two years, during an attack of bronchial pneumonia, the left eye protruded for three or four weeks but receded until the present difficulty.

Vision in each eye was 6/6; the right eye was normal. The left eye protruded 16 mm. but the lids could close over the cornea. A soft cystic mass was palpated at the inner third of the upper lid. This did not pulsate. Roentgenograms did not show evidence of any abnormality.

On September 10, 1919, an incision was made at the inner canthus up through the brow. Under the orbital septum was a large, long cystic mass filled with black blood. This extended along the nasal side of the orbit. When the cyst was removed, pressure on the globe would replace it into its normal position.

After operation, however, the eye did not recede entirely and exophthalmos was present throughout the patient's growth.

In 1937, the patient underwent exploration of the orbit by the transcranial approach. This was done elsewhere and the findings are not known to us. The left eye continued to be prominent.

The patient was seen again on August 19, 1946. She still was having an occasional hemorrhage in the orbit, and exophthalmos was present but not marked. Ocular rotations were normal. The lids were not swollen, the conjunctiva was not congested, and the fundi were normal. Results of roentgenograms of the optic canal were negative. Vision in the right eye measured 6/7 and in the left eye 6/6. Treatment was not given.

Case 6. Eight years before registration at the

clinic a white woman, aged 27 years, suffered complete loss of vision in the right eye within two weeks' time, but recovered her sight two months later. From that time on she noticed periodic protrusion of the right eye during which times it was painful to move the eye. The vision in the eye remained clear. At the time of the visit to the clinic the right eye was protruding more than previously. She had noted that when her head was lowered exophthalmos increased.

The patient's vision was 6/6 in the right eye and 6/5 in the left. The right eye protruded 3.0 mm.; the lids and conjunctiva were normal, and the ocular movements full. Pulsation was not present and a mass could not be felt in the orbit. The right pupil was equal to the left pupil and reacted normally. Ophthalmoscopic examination showed the veins to be tortuous, and the nervehead was slightly edematous. The left eye was normal as were also the visual fields and head according to roentgenograms.

Roentgen-ray therapy was given to the right orbit and the roentgenologic factors were as follows: 130 K.V., 6.0 ma., 4.0 mm. aluminum filter, distance 16 inches, 360 r in air, over three fields 5 by 5 cm. Two months later the patient returned for a second treatment. She had noted no change in the condition of her eye.

The patient's ophthalmologist wrote about her condition approximately three years after the roentgen-ray treatments, and stated that vision was good and that 2.0 mm. proptosis remained in the right eye.

Case 7. A four-year-old white boy having proptosis of the right eye was brought to the clinic one week after the occurrence of subconjunctival bleeding. Slight improvement was noted about two days later. Difficulty with the right eye began two years earlier when the eye suddenly bulged forward and the child cried with pain. The eye receded in about 15 minutes but later that day it bulged forward again and then receded. Since then the eye had been noticeably prominent many times, particularly when the child laughed or cried, but the episodes had not been painful.

Vision seemed to be good in both eyes but could not be measured because of lack of coöperation. Proptosis of the right eye measured 8.0 mm. and diffuse subconjunctival hemorrhage covered the whole globe. The pupil reacted promptly to light and funduscopic examination revealed a slightly pale nervehead and normal arterioles and veins. As the child struggled against having drops instilled into his eyes, the right eye would bulge farther forward about three-eights of an inch. The left eye was normal. General examination of the child did not show any other abnormalities and roentgenograms of the head showed it to be normal.

Treatment was not advised and the parents were requested to bring the patient back for further observation. This has not been done, however, and at the time this paper was written we had heard nothing more about him.

Case 8. Twelve years before this patient was seen in the eye section she began having ptosis of the right upper lid. This lasted about a week and disappeared, but two weeks later ptosis and exophthalmos appeared and persisted for about one week. During the next year ptosis and exophthalmos recurred associated with discoloration of the eyelids which lasted for a week or two. Between episodes, the eye and upper lid would return to normal positions.

After more than a year of recurrent attacks, the eye became proptosed and the lid lowered slightly with no return to normal. There still were variations in the amount of proptosis and ptosis followed by discoloration of the lids. The eye at the time of examination, in 1946, was as near normal as it had been at any time in the past 10 years. The vision in the eye had gradually failed.

The patient was 34 years of age, with vision of 3/60 in the right eye and 6/7 in the left with her correction. Proptosis of the right eye measured 5.0 mm. The eye was depressed in the orbit leaving an apparent shrunken area above the globe and beneath the orbital rim. The eye was freely movable and no mass could be palpated in the orbit. The patient had diplopia in all directions of gaze. The pupil of the right eye was larger than that of the left but reacted normally. The fundus was normal. The left eye was normal. General examination of the patient did not reveal other abnormalities and a roentgenogram of the orbit showed the presence of four phleboliths.

Transfrontal craniotomy was performed on the right side. The roof of the orbit was bulging into the cranium, discolored blue and as thin as tissue paper. As the wall of a large vascular channel was being freed it ruptured and blood which was apparently venous ran freely. The collapsed capsule was gradually freed and as much removed as possible. The phleboliths were in the nasal half of the orbit and there was some bluish tissue on the nasal side of the frontal nerve. This vascular mass was opened, the walls were pulled up, and the phleboliths removed. Bleeding was controlled by electrocoagulation. Microscopic examination showed vascular fibrous tissue containing four phleboliths.

Thirteen days after operation there was complete ptosis of the right upper lid; the vision remained 3/60. A letter written a month later informed us that the patient was regaining control of the lid.

Case 9. A white woman, aged 22 years, was first seen in the Section on Ophthalmology at the clinic on September 12, 1942. Five years before she had noticed slight protrusion of the left eye and lowering of the upper lid so that the eye appeared smaller than the right. The condition had not changed since then. She had had headaches in the left temporal region but these diminished when she was fitted with glasses.

Vision was 6/7 in each eye with correction. Proptosis of the left eye measured 3.0 mm. and the lid was 5.0 mm. lower than that of the right eye. Rotations of the left eye were slightly limited in upward gaze. No mass was palpable in the orbit

but the roentgenogram showed evidence of a mass of soft tissue overlying the left orbit with erosion of the superior orbital wall and a portion of the lateral wall. The fundi were normal and results of general and neurologic examinations were normal.

Transfrontal craniotomy was performed on the left, but there was no evidence of the soft-tissue tumor reported in the roentgenogram; the roof of the orbit was definitely thickened. A few bits of cholesterin crystals were found in the orbit and an angiomatous mass was uncovered. This was purplish in color and consisted of a large vessel about 3.0 mm. in diameter with multiple hairlike vessels attached to it. The mass was removed after being ligated. Microscopic examination of a section of the vessel showed it to be part of the venous wall.

Nine days after operation the vision was normal and the patient doing well. A follow-up letter with a photo in June, 1945, told that the left eye was in place with good vision.

Comment

The ages of onset of symptoms in the group of nine cases were all less than 35 years and eight of the nine patients were less than 23 years of age. The incidence as to sex of the patients and right or left eye could not be determined from this group. In all cases exophthalmos was unilateral.

In Cases 1, 2, and 3, intermittent exophthalmos was predominant, but in Case 3 there had been a few episodes similar to those in cases of recurrent exophthalmos. The exophthalmos in Cases 4, 5, 6, 7, and 8 was of the recurrent type; in Case 8 some permanent exophthalmos was present also. Case 9 was definitely the permanent type of unilateral proptosis.

Ecchymosis of the lids and conjunctiva was noted in five cases, all of which were of the recurrent type or were cases that had recurrent episodes along with either intermittent or permanent exophthalmos.

In five cases treatment was surgical with no improvement in two cases. An anterior approach was used in two cases and in three the transcranial approach through the roof of the orbit. The primary surgical difficulties seemed to be bleeding and collapse of the tumors during operation making removal almost impossible. Adequate roentgen-ray therapy was administered in one case and improvement followed. In three cases treatment was not given; follow-up reports in two of these showed no change in the condition.

Of the nine patients only two are known to have had impaired vision in the involved eye. One of these did not receive treatment and the other did not receive treatment until 12 years after the onset of symptoms. In one of the untreated cases the patient has retained good vision over a period of five years.

Summary

Reports of nine cases of venous aneurysm of the orbit are presented. The cases demonstrate unilateral exophthalmos that may be intermittent, recurrent, or permanent. Ecchymosis of the lids and conjunctiva occurred in all the cases in which there were recurrent episodes. Surgical treatment is difficult because of bleeding and collapse of the tumors.

The Mayo Clinic.

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NOTES, CASES, INSTRUMENTS

DENDRITIC TYPE OF KERATITIS CAUSED BY A WELDING ARC

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It is the purpose of this paper to present a case of dendritic keratitis caused by an exposure to the rays of an arc welding apparatus.

REPORT OF CASE

Mr. B., a welder's assistant, was seen on March 21, 1949. One day previously he received, without the benefit of eye protection, several welding flashes in his right eye at an approximate distance of one foot. His right eye was involved because of his tendency to turn his head to his extreme left. About two hours later, photophobia, pain, and lacrimation of his right eye occurred.

Externally, the left eye was negative. In the right eye, there was severe blepharospasm, marked edema of the lids, increased lacrimation, and severe palpebral and bulbar conjunctival injection.

Biomicroscopically, the cornea stained with fluorescein; there were numerous superficial punctate areas; and, extending from the 10- to 6-o'clock positions, there was a typical dendritic type of keratitis (fig. 1) with its characteristic epitheliolysis.

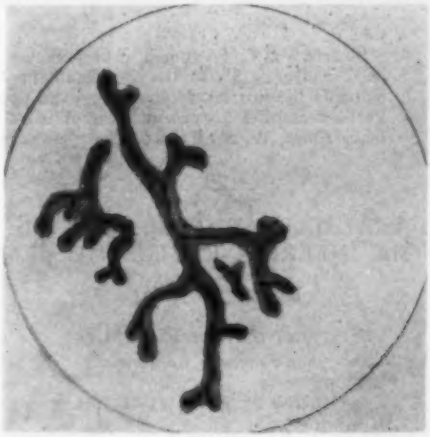

Fig. 1 (Sykowski). A sketch of the dendritic ulcer.

DISCUSSION

Duke-Elder[1] defines herpes simplex cornea as "a superficial epithelial infection characterized by the development of minute epithelial opacities and fissures, which may be followed by vesiculation and necrosis, the ultimate typical clinical picture being a dendritic ulcer."

Horner[2] first described the condition as a clinical entity. Gruter[3] demonstrated the existence of a specific virus in the vesicles of the corneal lesion.

The entity may occur as a purely local corneal manifestation or in the course of pyrexia, true or artificial. It has been described in influenza, pneumonia, pertussis, malaria, typhoid fever, intermittent fever, and so forth; after anti-typhoid inoculations; following prolonged treatment with arsenic; in association with artificial pyrexia induced by protein-chock diathermy, and malaria; with foci of infection[4] in the sinuses, tonsils and teeth; and in cases of menstruation. In the literature, trauma[5] appears to play no significant role.

Actinic keratoconjunctivitis (flash, photophthalmia) is the most common complaint reported by welders.[6] The welding arc produces high intensities of ultraviolet and infrared rays—the light waves ranging from 100 to 100,000 A.U.

The pathologic effects of radiant energy on the eye have been classically described by Verhoeff and Bell.[7] Duke-Elder[8] described characteristic histologic appearances. The lesions produced by ultraviolet rays are chemical in nature; those produced by infrared rays are definitely thermal in nature. Experimentally, in the cornea, there may occur any degree of change, and with severe exposures an opacity may be produced.

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TRAUMATIC DISINSERTION OF THE INFERIOR RECTUS MUSCLE*

Report of a case

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Review of the literature

Traumatic disinsertion of the inferior rectus is a rare type of ocular muscle injury. In a search through the recent literature, few case reports were found. In fact, no record could be found of a case of traumatic disinsertion of the inferior rectus muscle of several years' duration in which the muscle was successfully reattached by surgery with a perfect cosmetic result and single binocular vision.

Wiener and Alvis[16] mention acute traumatic disinsertion of the inferior rectus muscle, with successful reattachment about eight months after the injury.

Fig. 1 (Steiner). Preoperative appearance of the patient, with eyes in primary position.

Dimmer,[7] in 1903, wrote an excellent paper on traumatic paralysis of the ocular muscles, including the report of a case of disinsertion of the left inferior rectus, which he first saw six years after the original injury, produced by an iron bar flying from a machine and striking the patient's left eye. There was a scar, 10 mm. long, in the lower bulbar conjunctiva, with another scar in the skin of the lower lid, 7.0 mm. from the cornea (the region of attachment of the inferior rectus).

Vessels could be seen in the sclera and conjunctiva over the scar. In addition to disinsertion of the inferior rectus, impairment of function of the left internal rectus was present. These details are mentioned because similar findings were noted in the case to be reported in this article.

Dimmer concluded that the inferior rectus had retracted and become adherent behind the orbit. Because the conjunctiva in the region of the inferior rectus was not adherent to the sclera, he believed this did not speak against this type of wound, since a similar condition is seen after a tenotomy. He reported no operative result.

Four cases of this nature were mentioned by Berlin[2] in 1880, in one of which injury was due to the point of a knife and in another was caused by a stick. Guttmann,[8] in 1883, reported a case in which injury followed penetration of the eye by the horn of a goat; advancement of the muscle, done two years after the injury, gave satisfactory results.

Chevalier,[6] in 1884, reported a case of tearing of the inferior rectus caused by a dish, and Philipsen,[13] in 1887, described a

* From the Greens' Eye Hospital.

case in which the point of a nail was the traumatic agent. Diplopia persisted after replacement of the torn muscle.

In de Britto's[5] case, also published in 1887, the injury to the inferior rectus was due to a piece of iron wire. The muscle was advanced two weeks later, and the patient subsequently fused successfully. A. Graefe,[9] in the same year, cured his patient by advancing the muscle, which has been disinserted by a blow with scissors, more than a year after the accident. In Ahlström's[1] case, the injury followed a gunshot wound.

Hertel[10] described a case, in 1898, in which such an injury followed a fall against an open door. Bourgeois,[4] in 1891, and Laure,[11] in 1898, added one case each. In Hertel's case, tenotomy of the superior rectus was performed two months after the injury, with only partial success, the patient being obliged to lower the head to overcome diplopia. In Laure's case, advancement of the disinserted muscle was done four months after the injury, with eventual disappearance of the diplopia.

Berger,[2] in 1905, described a case in which the trauma was due to a piece of wire; the inferior rectus was advanced four months after the accident. The exact result is not given, but it is stated that the operation improved the condition.

It is noteworthy that Berger believed it advisable, in cases of acute traumatic paralysis of the inferior rectus, to wait for the blood to absorb. This requires only a few days, after which it is easier to determine whether paralysis or severing of the muscle has occurred. Partial severing of the muscle can end in return of normal function, as after an incomplete tenotomy.

Fig. 2 (Steiner). Postoperative appearance of the patient, showing eyes straight ahead and in all positions of gaze.

Anatomy of the Inferior Rectus

Several important points should be remembered in regard to the anatomy of the inferior rectus. This muscle, like the superior rectus, but unlike the medial (internal) rectus and lateral (external) rectus, is inserted

into the sclera in a dentate line. All the extraocular muscles are inserted into the sclera by fibers extending parallel to the long axis of the muscle. These fibers consist of fibrous tissue supported by thick elastic fibers. Apart from their size, they resemble the scleral fibers, being composed of the same tissue. The tendon fibers enter the superficial layers of the sclera and soon become indistinguishable from it. Only the cessation of the thick elastic fibers marks the place where one ends and the other begins.

Unlike any other muscles of the body, that is, instead of the muscle fibers being grouped together in bundles separated by dense connective tissue, the fibers are only loosely united and easily separated. From the origin for about 2.0 cm. the muscle sheath is practically nonexistent, being very thin and transparent.

The inferior rectus is the shortest of the four rectus muscles, being 40 mm. long. It forms an angle of 25 degrees with the visual line and is inserted into the sclera 6.5 mm. from the cornea by a tendon 5.5 mm. in length. The line of insertion is 9.8 mm. long, markedly convex forward, and always somewhat oblique, so that the nasal end lies nearer the cornea.

The inferior rectus is also attached to the lower lid by means of a fascial expansion of its sheath on the under surface, above the inferior oblique, then extends deep to the conjunctival cul-de-sac and palpebral conjunctiva, to be inserted between the tarsal plate and orbicularis. Thus this muscle acts on the lower lid as the levator acts on the upper lid. In fact, its action pulls the lower lid down two mm., and the lashes tend to be everted. This movement, however, is aided by the lid being in contact with the globe.

Actions of the inferior rectus

The primary action of the inferior rectus is depression, which increases as the eye is turned out and becomes nil when the eye is turned in. It is the only depressor in the abducted position of the eye. Secondary actions are adduction and extorsion, which increase as the eye is turned in. Its synergists are the superior oblique for depression (but not in the abducted position of the eye), the medial (internal) and superior rectus for adduction, and the inferior oblique for extorsion. Its antagonists are, in depression, the superior rectus and inferior oblique; in adduction, the superior oblique and lateral (external) rectus; and, in extorsion, the superior oblique and superior rectus. Its yoke muscle is the superior oblique of the other eye.

When the function of the inferior rectus is lost, there will follow overaction and perhaps contraction of either its yoke muscle or its direct antagonist, depending on which is the fixing eye.[14]

Report of case

History. H. C., a man, aged 20 years, was first seen on May 24, 1949, complaining of turning up of the left eye, with persistent redness of the lower half of the globe. He stated that in April, 1941, he had injured this eye by falling on a sharp stick. There had been a cut "under the left eye" after the injury. Details of the treatment given at that time were not known to the patient. He had been unable to see with the left eye for five weeks after the accident. Then double vision set in, and the eye was noted to be turned up. A physician had told him that a muscle in the eye was cut, but nothing was done about this condition.

To avoid double vision the patient habitually held his hand over the left eye for about two years, after which he became accustomed to using one eye at a time, and the vision remained good in both eyes. During the past year or so he had noted some decrease in the vision of the left eye and redness of the lower half.

His general health had always been good, and he had never worn glasses.

Eye examination. The distant vision, without correction, was 20/20 for the right eye and 15/20−1 for the left eye.

External examination of the left eye revealed a small healed scar on the skin of the

lower lid, in the medial third, near the margin. There was also a small healed scar at the margin of the middle third of the upper lid. The lower bulbar conjunctiva was extensively scarred, with abnormal injected vessels over and surrounding the scar near the anatomic site of insertion of the inferior rectus muscle. The sclera under the scar showed three small bits of black pigment.

Manifest refraction showed the vision of the right eye to be 20/20 with a +0.5D. sph., and the vision of the left eye to be 20/20−2 with a +0.5D. sph. ⊃ +0.25D. cyl. ax. 85°.

The Maddox-rod test revealed 30 prism diopters of left hyperphoria and 20 prism diopters of exophoria for distance and 29 prism diopters of left hyperphoria and 26 prism diopters of exophoria for near. The right eye showed 10 diopters of accommodation (normal); the left, nine diopters of accommodation (one diopter deficient). Convergence was poor, at times to six inches, and at other times the left eye did not turn in, the right eye converging to one-half inch.

No diplopia was present. In the primary position of the eyes the patient fixed with the right eye, the left eye deviating up and out. When the left eye fixated, the right eye deviated down and out. The left lower lid was retracted as though a recession of the inferior rectus had been done. The left eye had marked limitation of movement down and to the left and slight limitation of movement directly to the right. There was definite evidence of traumatic disinsertion of the left inferior rectus, with some weakness of the left medial (internal) rectus. Deviations as measured with prisms, in the primary position, were 30 prism diopters of left hypertropia and 20 prism diopters of left exotropia for distance and near. When the patient looked down and to the left there was 60 prism diopters of left hypertropia.

The red-glass test revealed vertical and crossed diplopia, with the image of the left eye below. The greatest separation of the images occurred when the patient looked down and to the left.

There was no evidence of intraocular injury.

Laboratory findings were normal. An X-ray study of the orbit showed an old healed fracture of the lateral wall of the left orbit, in good position.

Diagnosis. On the basis of the history and examination, a diagnosis of traumatic disinsertion of the left inferior rectus, with some weakness of the left medial (internal) rectus, was made.

Operation. On June 10, 1949, the patient was given a general anesthetic with ether. A horizontal incision of the conjunctiva over the scar was made, about 1.5 cm. long and about 5.0 mm. from the lower limbus. The scarred conjunctiva was carefully separated from the sclera with blunt and sharp dissection. After this was done, the site of insertion of the left inferior rectus was examined, but no tendon was found.

Some muscle fibers were noted about 12 mm. below the limbus; these were freed gently and identified as the inferior rectus muscle. Some of the fibers had to be separated and differentiated from those of the inferior oblique. These muscle fibers were grasped with a Prince forceps and brought forward as far as possible.

Three white cotton sutures (No. 40) were placed in the muscle, as near as possible to the Prince forceps, one mattress suture in the center and one single suture at each end. The assistant then rotated the eye down from above by grasping the upper limbus with a forceps. In this way the left inferior rectus was advanced to about 5.0 mm. from the lower limbus, the nasal end being slightly nearer than the temporal end. The sutures were tied under as little tension as possible.

With the patient still under general anesthesia, the position of the left eye was then compared to that of the right eye. The left eye still appeared to be exotropic. Apparently the left exotropia noted preoperatively was due to weakness of the left medial (internal) rectus. Therefore a conjunctival incision one cm. long was made on the medial side of the left eye, and a small tucking with

advancement of the left medial (internal) rectus was done. The conjunctiva was sutured with 6-0 black silk on an atraumatic needle. Penicillin ointment was instilled, and both eyes were covered with a bandage.

Postoperative course and outcome. Recovery was uneventful. The eyes appeared straight at the first dressing the following day. There was now moderate diplopia in the primary position, but most marked when the patient looked down and to the left. Fusion exercises with the synoptophore were begun, taken twice daily. In a few days the diplopia was overcome in the straight-ahead position, and on June 20th, the patient fused with six prism diopters base-down before the left eye. On June 23rd, on the telebinocular, he was able to overcome the slight left hypertropia to fuse three colors.

By July 1st, the postoperative reaction had disappeared for the most part. In the primary position there was only 0.5 prism diopter of left hyperphoria for near, as measured with the Maddox rod, with no hyperphoria for distance. The patient still had slight diplopia on looking to the extreme left and downward. There were five prism diopters of hypertropia on looking down and to the left, due to slight weakness of the left inferior rectus. Convergence was good to one inch, and the left medial (internal) rectus had excellent movement.

The patient was able to return to work three weeks after the operation. On August 26, 1949, there were eight prism diopters of left hypertropia when the patient looked down and to the left, and with the Maddox rod there was one prism diopter of left hyperphoria for distance and near.

On September 24, 1949, the findings were the same as those of August 26, 1949. The patient entered the Armed Services soon after his last visit and later went overseas. In October, 1950, his aunt informed me that he was still overseas and was not having any eye difficulties.

Comment

The abnormally injected vessels over the site of the conjunctival scar may have been due to the irritability of the conjunctiva of the lower cul-de-sac, which was exposed owing to the retraction of the left lower lid. It is known that the conjunctival epithelium differs in different regions. Over the tarsus there are two rows of cells, cylindrical and cuboidal. Over the fornix and bulbus a third layer of polygonal cells is present between the other two. The epithelium of the bulbus is more irregularly stratified and contains goblet cells having a mucus content.

It is difficult to understand how the vascular condition observed in our case could exist after eight years. One would think the abnormally exposed conjunctival epithelium would take on the same characteristics as the remainder of the bulbar conjunctiva.

The tendon of the left inferior rectus could not be found. If the muscle was torn from the tendon, it must be concluded that the tendon atrophied and became incorporated into the sclera, being composed of the same type of tissue.

The vision of the left eye remained nearly normal because the patient was able to suppress alternately. This was fortunate for him. Apparently no secondary contractures had taken place in eight years.

The weakness of the left medial (internal) rectus may be explained by the desire of the patient to avoid diplopia plus the decreased use of the left eye. This resulted in left exotropia.

No head tilt was present at any time in this case. Malbran[12] reported a case of traumatic paralysis of the left inferior rectus, with an atypical head tilt to the opposite side. Bielschowsky has stated that tilting occurs only if one of the obliques is involved. He is unable to explain why tilting does not occur with paralysis of the superior or inferior rectus muscle.

Summary and Conclusions

1. A brief historical review of traumatic disinsertion of the inferior rectus is given. The condition is very rare.

2. The important anatomy and physiology of the inferior rectus muscle are presented.

3. A case of traumatic disinsertion of the left inferior rectus of eight years' duration, with successful operative reattachment of that muscle, is reported. A small tucking with advancement of the left medial (internal) rectus was also necessary. The postoperative result was excellent, with binocular single vision.

4. The unusual features of this case are discussed.

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VOGT-KOYANAGI SYNDROME

Report of an atypical case

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The syndrome of poliosis, vitiligo, alopecia, and dysacousia associated with severe panuveitis was first described by Vogt in 1906. Studies on this condition have been further elaborated by many workers and, in 1941, after Koyanagi's report, it was named the Vogt-Koyanagi syndrome.

Report of an atypical case

History. A 30-year-old Latin-American man, native of the Rio Grande Valley, was admitted to Brooke General Hospital on March 30, 1948, with the chief complaint of sudden loss of vision in both eyes. He stated that his vision had rapidly dropped from normal to light perception only in the previous three weeks.

Past history revealed that for the previous two months he had had severe frontal headaches which were worse in the afternoon and evening. He stated that he had been constipated and had taken laxatives without relief. He had had several teeth removed in the recent past with the hope of relieving his headaches but to no avail.

Early in March, 1948, he sought the aid of a local physician who performed an ophthalmic examination and noted that the media were slightly hazy but saw no evidence of a retinal pathologic condition. A urinalysis, blood count and serology were done at this time and reported as normal.

The patient was sent home, vitamin tablets and analgesics were prescribed, and, during the following week, the blurring became more severe as did the headaches, and he noted the onset of dizziness. On March 19, 1948, he returned to his local doctor with further complaints of difficulty in con-

centrating and loss of hearing. A diagnosis of plastic iritis was made and he was hospitalized.

He was treated with atropine, penicillin, and given two injections of typhoid antigen. The response to this therapeutic regimen was poor and on March 30, 1948, he was admitted to Brooke General Hospital with bilateral loss of all vision except light perception, severe headaches, hearing loss, dizziness, and inability to concentrate.

Physical examination. Examination at the time of admission was negative except for the eye findings and the audiograms. The lids and adnexa were normal. There was marked pericorneal injection, bilaterally. The pupils were irregular, five mm. in diameter and fixed due to extensive posterior synechias. There were many mutton-fat keratic precipitates present and a four-plus aqueous beam was noted bilaterally, with many floating cellular elements in the anterior chamber. A bulging of the iris resembling iris bombé was noted bilaterally. The tension was 11 mm. Hg (Schiøtz) in each eye. Neither retina could be visualized because of the hazy media.

Field examinations with a flashlight as a test object showed no marked field loss and good light projection in each eye. Audiograms at this time revealed a 41-decibel loss of the nerve type, bilaterally. Bárány-chair testing suggested slightly depressed vestibular function.

Laboratory data. Urinalysis: negative, except for 4 to 6 white blood cells per high-power field. Blood chemistry: sugar, 114 mg. percent; urea nitrogen, 15 mg. percent. Blood count: 95 mg. percent hemoglobin; 8,500 white blood cells, with 70 percent neutrophils and 30 percent lymphocytes.

Spinal tap (April 7, 1948) revealed 78 lymphocytes per c. mm.; 71 mg. percent sugar; 68 mg. percent protein; 526 mg. percent chlorides. Cultures of spinal fluid were negative for organisms including acid fast.

Agglutinins for tularemia were negative; undulant fever, 3+ at 1 to 40 and 1+ at 1 to 80; Weil-Felix, 3+ at 1 to 60 and 1+ at 1 to 320. Wassermann was negative. Stools were negative for enteric pathogens. A glucose-tolerance test was within normal limits except that sugar appeared in the urine on the third and fourth specimens.

Course in the hospital. The patient was placed on penicillin (400,000 units) and sulfadiazine (six gm.) daily, on admission. This was continued for three weeks. At this time a course of streptomycin (one gm. per day) was started for a three-week period.

The lymphocytosis and protein in the spinal fluid disappeared in two-and-one-half weeks from time of admission. Repeated blood counts revealed a relative neutropenia, 4,600 to 6,000 white blood cells, with a normal differential. Later spinal taps were all normal. Complement fixation series for neurotropic viruses were repeatedly negative.

Neurologic examination revealed no abnormality throughout the course. X-ray studies of the skull, chest, and orbits were negative. An electro-encephalogram done in May was normal.

Early in May, 1948, a patchy alopecia was noted. At this time large patches of hair were noted to fall out with the slightest pull on them. The patient was seen by the dermatologists who noted that this form of alopecia areata was most frequently seen in syphilis. Serial dilutions of Wassermann reactions were negative at this time.

Throughout the patient's hospital course, his eyes continued to show signs of active uveitis. There was a gradual deepening of the anterior chamber bilaterally which was thought to be due either to a shrinkage of the vitreous or the presence of a cyclitic membrane. A paracentesis of the anterior chamber of one eye was done and complete bacteriologic study of the fluid was negative. Throughout his hospital stay, formation of a secondary pupillary membrane proceeded, which further limited examination of the posterior segment.

In June, 1948, since no further benefit

was considered to be possible by hospitalization, the patient was discharged from the hospital with light perception only in either eye. At that time the eye findings were essentially as have been noted. There had been some recovery of hearing, bilaterally, and the alopecia was rather marked. All symptoms of headache and inability to concentrate had disappeared about one month previously.

Follow-up. The patient was not seen again until February 10, 1949, at which time he said he had been in good health since discharge. He stated that his hearing had been completely recovered, although he frequently had a noise in his ears which resembled a cricket. His hair had grown back to its normal state and color in the preceding several months. He had no pain in either eye and stated that his vision had remained unchanged.

Physical examination was normal except for the ocular findings. Vision was light perception only, bilaterally, with good light projection. Lids and adnexa were normal except for sparse eyelashes. Both corneas showed diffuse interstitial vascularization of the terminal loop type. Throughout the corneal stroma several small disclike opacities were noted. Marked keratic precipitates were present but their margins were crenated. There was a two-plus aqueous beam, the anterior chambers were extremely shallow, and there were numerous anterior peripheral synechias. The irises showed marked neovascularization. A dense pupillary membrane was present which was similarly vascularized. Tension was 6.0 mm. Hg (Schiøtz). Light fields were normal. The lens in the left eye was densely opaque. Except for this last finding, both eyes were similar.

Summary

This patient, who showed acute onset of marked pan-uveitis, nerve-type hearing loss, alopecia areata, and lymphocytosis of the spinal fluid, has been followed for a period of one year. Almost all of the previous findings have been resolved except for the ocular manifestations which now appear to be progressing to phthisis bulbi.

This case readily falls into the syndrome described by Vogt but it lacks two of the outstanding features of the syndrome Vogt described. These are poliosis and vitiligo. However, according to Parker, these features are present in only about 70 percent of the cases.

Brooke General Hospital.

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FIXATION LIGHT FOR SLITLAMP IN REMOVAL OF CORNEAL FOREIGN BODIES

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Many ophthalmologists will agree that it is, at times, impossible under ordinary conditions for a patient to hold his eye still while a foreign body is being removed from the cornea. I have used the slitlamp, almost routinely for several years, when removing such foreign bodies. This instrument gives excellent illumination, and the magnification and visibility rendered by the corneal microscope gives nearly perfect control, especially when the eye is held still. Figure 1 shows how a small light can be used for fixation

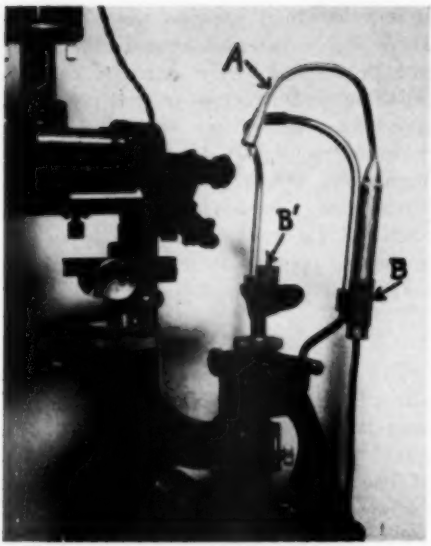

Fig. 1 (Spencer). Fixation light for slitlamp.

while the foreign body is being removed.

The light, "A," which is a small electrician's trouble light (obtainable at most any hardware store) is attached to the frame of the slitlamp head rest. In this case the two ordinary penlight batteries of the light "A," have been replaced by a low-voltage element, which is wired to a small rheostat and transformer so that the light can be plugged into the 110-120 volt city current.

It is wise to use a relatively high-voltage light blub (10 or 12 watts), the filament of which will then only produce a faint glow; this makes steady fixation possible even when the bulb is close to the eye. The light slips into one or the other of the two removable housings, "B and B'," which slide up and down on each side of the frame and are mounted with set-screws.

The semiflexible cable holding the bulb is long enough so that the bulb can be adjusted to any position from either side of the frame; it is seldom necessary to change it from one side to the other.

The idea for this is not entirely original but was developed following a lecture delivered in San Francisco by Professor Lindner of Vienna. He spoke of using a tiny movable light for controlling the patient's eye movement during slitlamp examination of the fundus.

135 Montevista Avenue.

A LID RETRACTOR FOR CATARACT SURGERY*

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AND

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A controversial but important consideration in intraocular surgery is the control of the lids. There are numerous methods available to us but all have limitations. These shortcomings will be discussed and a suggestion as to what we believe a more desirable method will be presented.

Adequate exposure of the operative field is essential in all surgery. There are several factors which alter the degree of exposure in ophthalmic surgery—namely, a deep-set eye or a relatively short palpebral fissure. Exposure might be inadequate, in many cases, even after lateral canthotomy. Prominent globes may occur as a familial characteristic, in high myopia, or in exophthalmos. Here the exposure is always adequate but the problem is the means of obtaining lid retraction without causing pressure on the globe.

There are three commonly employed methods of lid retraction in ophthalmic surgery:

1. *Speculum.* Though convenient, this has limitations. In spite of the definite pressure exerted by this instrument on the globe, it is

* From the Department of Ophthalmology, New York City Hospital. These retractors may be obtained from the Storz Instrument Company, Saint Louis 10, Missouri.

still the most commonly used method. Spaeth[1] considers it a dangerous instrument. Fridenberg[2] included it among the dangerous traumatisms to the eye from faulty instrumentation.

While it is true that the pressure exerted on deep-set or normally situated globes is not great, there is a definite amount of pressure. This assumes hazardous proportions in protruding globes and dislocated lenses. The speculum is definitely contraindicated in these conditions.

The main source of pressure is from the weight of the central or screw end of the speculum which is the most dependent part of the instrument and exerts pressure on the lateral aspect of the globe. Some surgeons try to minimize this by inserting cotton pledgets between this end of the instrument and the skin surface of the lateral orbital margin. While this is of some aid in the normally situated globe, it is still dangerous in the protruding globe.

Another shortcoming which has been experienced by all surgeons is that the speculum is not quickly removable in times of danger. Finally, if the lips of the speculum are not easily placed between the lid and the eyeball after lid akinesia, it should not be used in that case.

Many of the above objections are done away with in retractors such as suggested by Guyton.

2. *Lid sutures.* Many of those who object to the speculum because of the shortcomings already cited utilize lid sutures. The exposure is as good or better and the lids are closed more easily at the conclusion of surgery. However, it is often not realized that the very dangers they seek to avoid are present in this method.

When traction is placed on the lid margin in a direction away from the globe, the lid folds to form a V the apex of which is at the tarsolevator junction. Thus the upper edge of the tarsus is turned inward and exerts pressure on the globe. Again, in cases of protruding globes, this is of serious consequence. If the vertical width of the tarsus is small, the danger is less. If large, the danger is more, since the upper edge presses more posteriorly on the globe and in a more perpendicular direction.

In addition, the use of lid sutures requires further injections for anesthesia and consequently will show other factors such as lid swelling, pain of another injection, and so forth.

3. *Lid retractor for upper lid and assistant's finger for lower lid.* Here, an assistant elevates the upper lid with a Desmarres retractor and depresses the lower lid with his fingers. This is a most satisfactory method. There is no pressure exerted on the globe and the exposure is adequate. Spaeth recommends this method.

There are certain objections, however. If one assistant is available both his hands are occupied with this all important task. A lapse in attention may prove disastrous. The surgeon must occupy himself with duties ordinarily assumed by his assistant, thus his attention is often removed from the operative site.

Most of these objections are minimized if there is a second assistant. However, the hands of the assistant effecting retraction and the retractor itself may interfere with the surgeon, since it is situated in the upper part of the globe and limbus where most of the surgery takes place. While the principles employed here are good, there is still much to be desired.

Another method of retraction has been one similar to what we propose but the retractors are kept in place by screws tightening the apposition of the retractor to the lid. In our experience the tightening not infrequently causes a squeezing out of meibomian secretion and theoretically adds to the possibility of local infection if any latent organism finds its habitat therein.

We have used with great success and convenience separate upper and lower lid retractors (figs. 1, 2, and 3).

The curved end of the retractor fits be-

hind the tarsus. The retraction is in the direct line of action of the lids. The retractor is sufficiently broad so as to eliminate notch type of retraction as with lid sutures. The

Fig. 1 (Givner, Jaffe, and Teschner). Frontal view of lid retractor. Width is sufficient to eliminate notch-type retraction.

Fig. 2 (Givner, Jaffe, and Teschner). Side view of lid retractor. The length of the short arm is equal to that of the tarsus, thus eliminating any possibility of bending of the tarus. The space between the long arm and short arm is sufficient to accommodate the eyelid.

curved part of the retractor is approximately the same length as the tarsus thereby eliminating any bending or folding of the tarsus. The blades completely enclose the tarsus. There is absolutely no pressure on the globe. The exposure exceeds that obtained with the speculum and lid sutures. No assistant is required to hold the retractors.

A heavy (No. 1) black silk is tied to the end of the rectractor and this is clamped above to the towel draping the patient's head and below to the sheet over the patient's body and chest. The retractors are simple in design, require no spring or lock, and are made of stainless steel. They may be bent

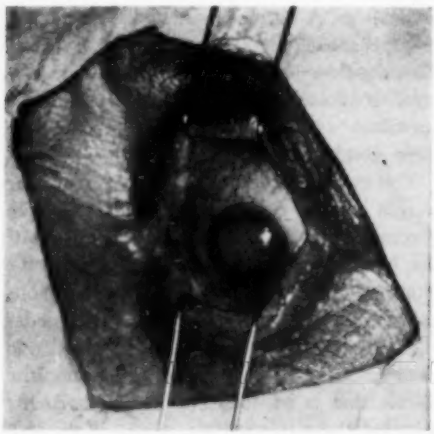

Fig. 3 (Givner, Jaffe, and Teschner). Separate upper and lower lid retractors in place. Note the space between lids and globe. There is adequate exposure and no evidence of pressure on the globe at any point.

if necessary to accommodate the curve of the supraorbital margin. They are indispensable in cases with protruding globes or where only one assistant is available.

We have found them to be the most desirable method of retraction.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

PITTSBURGH OPHTHALMOLOGICAL SOCIETY

January 30, 1950

DR. J. S. PLUMER, *presiding*

UVEITIS

DR. ALAN C. WOODS of Baltimore (guest speaker) stated that there are few diseases as challenging and in which it is as difficult to make an etiologic diagnosis as uveitis. The commonest causes of granulomatous uveitis are syphilis, tuberculosis, brucellosis, toxoplasmosis, virus diseases, and, perhaps, histoplasmosis. A good history is important, including family history, past history, present illness, and course of disease.

The important differential points between granulomatous and nongranulomatous uveitis were then outlined. The pathologic features of the five were compared.

Dr. Woods outlined the needs for consultants, yet stressed that the ophthalmologist must be the "captain" of the team during the investigation.

The common diagnostic pitfalls in granulomatous uveitis are such things as the negative blood serologic test produced by inadequate treatment of lues and the pleomorphism of tuberculosis uveitis.

In tuberculosis, the clinical appearance of the eye, exclusion of other causes, and interpretation of the tuberculin reaction are most important.

Brucellosis is difficult to diagnose. History and blood agglutination are probably more important than the cutaneous test and complement fixation test. About 40 percent of brucellosis patients showed definite eye disease.

Toxoplasmosis is probably becoming more frequently diagnosed. Virus disease is difficult to interpret.

Dr. Woods then outlined a systematic nine-day study of uveitis cases. A positive diagnosis is obtained in 50 percent of cases, presumptive in 30 percent more, and no diagnosis in about 15 percent.

Discussion. Dr. William Linhart: Have you encountered any ocular tuberculosis from BCG vaccinations?

Dr. Woods: No.

Dr. Plumer: Please outline your means of desensitizing with tuberculin.

Dr. Woods explained Rich's law:

$$\frac{\text{Allergy} \times \text{number and virulence of organisms}}{\text{Resistance of host}}$$

and stated that we must build up the patient's resistance, eliminate allergy, and employ a direct attack on the tubercle bacilli, such as streptomycin therapy.

Dr. Statti: Approximately what percentages of lues, tuberculosis, brucellosis, and Boeck's sarcoid cause uveitis in your experience.

Dr. Woods: Lues, 20 percent; tuberculosis, 46 percent; brucellosis, six percent; Boeck's sarcoid, six percent.

C. William Weisser,
Recorder.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

January 19, 1950

DR. WILFRED FRY, *chairman*

PRESENT STATUS OF RETROLENTAL FIBROPLASIA

DR. V. EVERETT KINSEY (guest speaker) reviewed this condition from the work of Terry to the present. He presented statistics

of incidence in several cities, and referred to the work of other authors, as well as himself. Various suggested methods of treatment and their shortcomings were discussed. The role of vitamin E was presented as being the most recent attempt at a therapeutic solution of the problem. Dr. Kinsey expressed the opinion that, as of the present, a great deal more work on the subject will probably be required before the problem is solved.

Discussion. Dr. Charles C. Chapple: I wish to make some general remarks on growth, especially that of premature babies. Since most retrolental fibroplasia occurs in such infants, and is a disturbance of the normal growth of the eye components, my remarks will apply, in a general way, to it.

The term "growth," as it will be used here, includes the growth of blood vessels and other body parts as well as growth in length. It is frequently considered in one or another manifestation just as we tend to regard individuals in terms of separate parts, each independent of the rest. This is a tendency of medicine, in general, which is certainly as great in pediatrics as it is in ophthalmology. A glance, however, shows that there is reason to regard the individual as composed of integrated and indissoluble functions and parts. For example, the same hyaluronic acid present in the vitreous humor of the eye is present in the skin and elsewhere. Presumably any substance capable of changing it in one location should be capable of changing it wherever it may lie.

The blood vessels throughout the body have much in common with those of the eye, and each blood vessel has a nerve and each nerve a blood vessel. They both are nourished by the same blood which, not being an entity, is changed in cellular constituents and composition with changes in the glands and other parts which manufacture its components, and with changes in the permeability of the vessel wall.

All this is obvious, and may be said of adults as accurately as of premature infants. These infants are unlike adults in certain respects, however. Unlike adults, the premature infant is about to undergo, or is undergoing, the greatest growth spurt of his life. His vessels, skin, bone, and all his other parts are subjected to a potent growth stimulus. Normally, some of this is intrinsic, and some may be acquired from his mother. But when he was born he started to rely on his environment for any stimulus not inherent in his own body.

Light, particularly ultraviolet light, vitamins, and certain other substances are capable of affecting growth, but they are not all equal in this capacity to affect it, and it seems that they may not all affect it even in the same direction. Unfortunately, there is all too little known about this subject.

Even vitamins are not clearly understood in this respect although the action of some seems evident. Vitamin D, for example, induces calcification which really is the opposite of growth stimulation. Calcification is a maturation phenomenon, or, to express it in other words, a consolidation of the gain made during the growth phase.

These phases of growth and consolidation, or maturation, alternate normally on daily, monthly, seasonal, and longer bases. Usually, the rhythm is regular between the phases, but stimulators of one or the other mechanism can prevail and maintain one phase at the expense of the other.

Vitamin C's role apparently parallels vitamin D's. That is to say, its action on the maintenance of integrity of the blood-vessel wall is similar to the solidification of bone calcification, but vitamin A seems to oppose vitamin C's action as evidenced by the fact that an excess of vitamin A induces bone changes which are remarkably similar to those resulting from a deficiency of vitamin C, or scurvy.

This does not seem unreasonable, however. These magic bits called "vitamins" are separated from plants and animals which made them for their own use, to activate one phase or the other. On this account, they should not be expected to be synergistic in another

species, when they are, in a sense, antagonistic in the species of their origin.

Since there is much evidence to support this, it seems reasonable that vitamins should be investigated more fully for the direction of their affect on growth. Meanwhile, vitamins given without definite indication should be dropped from the regimen generally prescribed for premature infants until more is learned of these effects especially on the growth of blood vessels.

I might digress here to say that our approach to vitamin administration is a negative one. That is, for the most part, we give vitamins only to prevent deficiencies, and not because of beneficial effects known to be induced by them. We accept standards of dosages which have been established largely on this basis in animals, or in older individuals than premature infants. These infants may require more as is so often the case, or, on the other hand, and more importantly, may require none at all of certain of them. It is not inconceivable that the administration of these might even be harmful.

In addition to vitamins certain vehicles previously thought to be inert have been shown to exert a strong influence on growth. One of the most striking of these is propylene glycol with which we have done considerable work, and which should be regarded with suspicion until its stimulating action is established to be of the nature desired. Even mineral oil and aspirin have been shown by Zondek and Ascheim to have stimulatory effect on the calcification of bones of animals, hence are growth effectors.

Because of the diversity of their chemical natures and the apparent ubiquity of growth-affecting substances, it seems evident that such evaluation as was mentioned as advisable for vitamins might be profitable for their vehicles, and might be extended to include foods, in order to learn what might be suspected as a cause of growth disturbances of many types. It would seem especially advisable to study those to be administered to premature infants whose immature structures can respond so strikingly to a stimulus which may be incapable of damaging a more mature individual.

My remarks can be summarized as a plea for us all to consider the individual as a whole, and to require real indications before allowing indiscriminate administration of substances which may influence growth.

Dr. William O. La Motte, Jr.: I have heard some vague rumblings somewhere about the possibility of vitamin E even being contraindicated in these premature infants, and would like to know if Dr. Kinsey or Dr. Chapple have any comments in this connection.

Dr. Elizabeth Kirk Rose: I would like to know if the incidence of retrolental fibroplasia is really as low in Philadelphia as has been implied? We have seen in just the past six months three cases in 15 of the prematures under three pounds at birth in the premature station at the University Hospital, and Dr. Henry Lee tells me they have had three cases in the last 14 premature births at Pennsylvania's Lying-in Hospital. It is rather distressing to watch these cases develop under your eyes.

The second thing I should like to comment on is the rate of blood-vessel proliferation in premature infants, as evidenced by the increased incidence and growth of telangiectasias or hemangiomas, and to raise the question of a relationship between this phenomenon and the occurrence of retrolental fibroplasia.

Dr. Irving H. Leopold: I would like to raise a question, if only to have it authoritatively denied.

Last month Dr. LaMotte presented statistics from a Wilmington hospital showing that, the year before he started his routine observation of the fundi of premature infants, the incidence of retrolental fibroplasia was very low and, during the year in which he watched these fundi regularly, the incidence increased. Dr. Rose mentioned the statistics of the University Hospital where

the fundi were not examined routinely for a number of years, the incidence was very low and now that the fundi are examined regularly, the incidence has increased. I believe the same thing is occurring in other hospitals throughout this city. Either we were missing them in the past, or else observing them at frequent intervals has something to do with the increasing incidence of the disease.

Dr. Henry Lee: I want to raise one other question, and I haven't any real data. We are a little bit concerned about stilbestrol because of the effects it may have on the newborn, and also the effect it has on premature infants. We know, of course, that obstetricians sometimes must use stilbestrol in very significant doses, but we are beginning to be quite concerned about the possible effects upon the baby. I wonder if Dr. Kinsey has found any correlation in his investigation of these various series between the use of stilbestrol or other estrogenic substances and this particular condition.

Dr. V. Everett Kinsey (closing): I will answer the discussors in reverse order.

I know nothing about the use of stilbestrol, but I have marked it down to look it up. I think any possibility is certainly worth investigating.

Dr. Leopold's comment that observing the babies might increase the incidence of retrolental fibroplasia reminds me of another experiment which proved nothing, but was expected to prove nothing. May this condition possibly be due to a virus in the infant, or in the mother, for that matter, like a congenital cataract? We have not been able to correlate retrolental fibroplasia, as you saw from our figures, with any infection in the mother. Still it is possible, of course, that it is due to an infection which doesn't show up in an adult, which could be occurring (especially a virus infection) without any symptoms and would, therefore, be overlooked. That is a possibility.

It is possible that it is a virus in the infant acting postnatally. To study this, we took some aqueous humor from an infant, developed it, and injected it into the intravitelline. As Dr. Horsfeld pointed out: If you get something, that is wonderful; if you do not, it does not prove anything. In this case today, we got nothing. Dr. Horsfeld also aptly pointed out that, in the case of mumps, there is no question but that the disease is due to a virus, but you can't draw the virus out. So a whole new line of thought centers around whether or not a virus is involved.

Dr. Leopold's suggestion brings up the question of contagion.

Against the thought that examining these infants does any harm are two factors. First, if the babies are being examined with an ophthalmoscope, one might immediately say it is the light. I think Dr. Krause eliminated that argument by covering the eyes for a 45-day period. He pointed out quite carefully in his article that the babies were not examined during that 45 days. At the end of 45 days when the infants were examined, the investigators were surprised to find four cases of retrolental fibroplasia. That would seem to be evidence that the light does no harm, although not very good evidence perhaps.

The second factor is that, in Boston, our cases weren't looked at either for a period of years. The premature infants were not examined routinely; in fact, the staff at the Lying-in Hospital never saw a single case in the hospital, although 40 cases developed in the hospital as we subsequently discovered. The pediatrician knew nothing about these cases; nor did the ophthalmologist because the eyes weren't examined closely enough, nevertheless, these children subsequently were examined and found to have retrolental fibroplasia. I suspect examining the infants cannot be correlated with the development of the disease.

As to the incidence of the disease in Philadelphia—I heard at dinner tonight that the University Hospital now had three cases, and I was also interested to learn that these babies weighed less than three pounds. It

seems to me to be very interesting that often when there is a high incidence, the disease is found in the heavier infants.

At Baltimore, where a lot of examinations have been made, the disease is so rare in infants who weigh over three pounds that, I understand, they don't examine heavier infants any more. In the last year at the Boston Lying-in Hospital, all eight cases occurred in infants weighing over three pounds. Dr. LaMotte's cases are in the heavier group. The cases of Dr. Ensworthy at Hartford, where they have a high incidence, also occurred in the heavier infants.

I don't know what this means, but I think it is very interesting to speculate why the disease first starts in the babies of lighter weights and then begins to develop in the heavier ones, and at a time when the incidence is high in both types.

M. Luther Kauffman,
Clerk.

CHICAGO OPHTHALMOLOGICAL SOCIETY

December 19, 1949

Dr. Derrick Vail, *president*

Clinical meeting

(Presented by the Department of Ophthalmology, Northwestern University School of Medicine, and the Department of Ophthalmology, Children's Memorial Hospital)

Posttraumatic anterior-chamber cysts

Dr. Edward J. Zeiss (Appleton, Wisconsin) presented two cases of posttraumatic anterior-chamber cysts successfully treated by electrocoagulation.

Case 1

History. B. A., a white man, aged 26 years, employed as a mechanic, was seen on July 23, 1946. He stated that two hours earlier while placing a bearing in a car he struck the bearing with a hammer and, as he did so, felt a severe stinging pain and noticed a blurring of the vision in his right eye.

Eye findings. Vision in the right eye was light perception and projection. The blepharospasm, photophobia, and lacrimation were severe. The cornea had an irregular penetrating wound one mm. from the limbus at the 7-o'clock position. The wound extended for about two mm. toward the pupil. The anterior chamber was collapsed. The iris had a jagged tear at the 7-o'clock position, which on transillumination showed a complete hole. The pupil was ovoid in shape and was eccentrically displaced toward the 7-o'clock position. The lens was moderately opaque with anterior and posterior cortical opacities extending from the periphery between the 6- and 8-o'clock positions toward the center of the lens.

The media were hazy. The fundus details could not be seen. The roentgenogram revealed an opaque intraocular foreign body.

Vision in the left eye was 20/13; 14/14. All objective findings were normal.

Surgery. Anesthesia was four-percent cocaine, topically; two-percent novacaine, subconjunctivally and retrobulbarly.

The foreign body was brought to the iris at the 8-o'clock position with the electromagnet. A van Lint conjunctival flap was prepared between the 6- and 9-o'clock positions and a corneal scleral suture was placed between the 7- and 8-o'clock positions. An external limbal incision was made between the limbus of the suture and the iris was incised over the foreign body. The foreign body was then removed with the magnet.

A brisk hemorrhage occurred as the foreign body left the eye. A slight amount of blood infiltrated into the anterior chamber. The toilet of the wound was completed and the conjunctival flap was sutured over the limbal wound.

Postsurgical treatment consisted of pro-

phylactic anaerobic vaccine, penicillin, and sulfonamides.

Course. The postoperative course was uneventful. A dense corneal opacity developed at the site of the wound and limbal section. The cataract became complete and partially absorbed. Six months later on January 4, 1947, a discission was made through the anterior lens capsule, following which most of the lens substance absorbed, leaving a thin posterior capsule.

On February 20, 1947, eight months following the injury, a small disc-shaped refractile mass about three mm. in size appeared between the cornea and iris at the 8-o'clock position, the site of the penetrating wound and limbal section. A diagnosis of posttraumatic implantation cyst was made. Since the cyst caused no elevation of tension or other symptoms, conservative watchful waiting was followed.

On April 1, 1947, an uneventful discission was made through the posterior capsule. The cyst had remained stationary in size and caused no reaction. On June 9, 1947, a refraction was done, the corrected vision being 20/25. The cyst showed no change.

On July 1, 1947, almost a year after the primary injury the patient complained of severe pain. The photophobia and lacrimation were severe. The bulbar and ciliary hyperemia were moderate. The cyst had increased greatly in size and filled the lower two thirds of the anterior chamber extending from the 5- to 10-o'clock position. Schiøtz tension was 26.5 mm. Hg, suggesting that most of the symptoms were due to iritic and corneal irritation.

Sedatives, analgesics, and a 0.5-percent solution of pilocarpine were prescribed.

The symptoms continued until August 9, 1947, at which time coagulation surgery was undertaken with sodium-pentothal anesthesia. Six Kalt corneal needles were passed through the clear cornea at hourly intervals from the 5- to 9-o'clock positions. The cyst did not rupture and all of the needles were placed without incident. With a mild coagulation current, the needle at the 8-o'clock position was activated to the point of producing a visible coagulation sleeve in the cornea. The cyst collapsed as soon as the current was applied. Each needle was similarly activated with the current. On removing the needles a slight resistance was noted, but there was only slight damage to the cornea and the anterior chamber did not collapse.

Postoperatively, the patient had a photophobic red eye of moderate severity for a period of three weeks. The cornea healed with a dense white scar extending 2.5 to 3.0 mm. beyond the limbus. When last seen on March 10, 1949, one year and nine months after the coagulation procedure, there was no evidence of recurrence of the cyst. The Schiøtz tension was 15 mm. Hg, and the corrected vision was 20/30−2.

Pathogenesis. I am of the opinion that this was a posttraumatic epithelial implantation cyst or epithelial ingrowth. A very complete and illustrated paper on the subject was published in the *Transactions* of the American Academy of Ophthalmology and Otolarngology, May and June, 1948: "Epithelial invasion of the anterior chamber following cataract extraction," by Georgiana Theobold and Joseph Haas.

Case 2

History. C. W., a white boy, aged 11 years, was playing football on April 16, 1946, when he ran into a tree, injuring his right eye.

Eye findings. Vision in the right eye was light perception and projection. The lids showed moderate ecchymosis at the inner angles. The bulbar conjunctiva was torn from the globe between the 3- and 6-o'clock positions but remained attached at the limbus. The inferior rectus muscle was torn from its insertion in the temporal one half. The sclera had a small perforating wound six mm. from the limbus at the 4-o'clock position through which the uvea prolapsed slightly. The cornea was clear. The

anterior chamber was deeper than normal in the lower one half. The pupil was ovoid in shape and slightly displaced toward the 4-o'clock position. The lens was thought to be partially subluxated.

Fundus details were obscured by a vitreous hemorrhage.

Vision in the left eye was 20/13; 14/14. All objective findings were normal.

Surgery. Sodium-pentothal anesthesia was used. The inferior rectus was sutured to its original insertion with one catgut mattress suture. The scleral puncture was cauterized with trichloracetic acid. The conjunctival edges were debrided, undercut by blunt dissection, and closed with interrupted silk sutures.

Medical treatment consisted of prophylactic anaerobic vaccine, penicillin, and sulfonamides. The postoperative course was uneventful; the vitreous gradually cleared.

On July 16, 1946, three months later, the eye became irritated. A foreign body presented subconjunctivally near the limbus at the 6-o'clock position. Under four-percent cocaine topical anesthesia, a small puncture was made through the conjunctiva and a sliver of wood, 1 by 5 mm., was removed. On September 20th, when the patient was discharged, corrected vision in the right eye was 20/13−3; 14/14.

A year and two months later, on November 10, 1947, the patient returned complaining of a sore eye for the past week. Vision in the right eye was light perception and projection. Photophobia and lacrimation were severe. There was moderate bulbar and ciliary hyperemia. The cornea was clear. The anterior chamber contained a purplish brown semitransparent cyst in the inferior nasal one third. The cyst lay between the iris and the lens. Schiøtz tension was 9.0 mm. Hg. A diagnosis of posttraumatic anterior-chamber cyst was made.

Surgery. Under sodium-pentothal anesthesia, five Kalt corneal needles were passed through the cornea and iris into the cyst. When the current was applied to the first needle, the cyst collapsed. The degree of coagulation was mild as in Case 1.

The postoperative course was moderately severe, with photophobia, lacrimation, pain, and severe bulbar and ciliary hyperemia. Complications were a dense corneal opacity extending two mm. into the cornea from the 3:30- to 6-o'clock position. The pupil was distorted and displaced almost to the limbus at the 4-o'clock position and was similar in appearance to a congenital coloboma. The lens was moderately opaque in the inferior nasal sector.

When the patient was last seen on November 25, 1949, two years after the coagulation procedure, there was no evidence of recurrence of the cyst. Vision in the right eye was 20/200 with and without correction. Schiøtz tension was 16.5 mm. Hg. The lens showed an increase in density of the anterior and posterior cortical opacities.

Pathogenesis. I believe this cyst arose from the posterior pigmented layer of the iris. Whether it belonged to the class of epithelial implants or whether it was a foreign-body cyst is questionable.

In conclusion, I would suggest that posttraumatic cysts of the anterior chamber can be successfully treated by electrocoagulation. In aphakic eyes there is no need to fear severe complications if the cyst lies between the iris and cornea. In phakic eyes, there is the danger of secondary cataract, though in the first case presented the cataract may have been secondary to the trauma since the lens was thought to be subluxated at the initial examination.

When coagulation must be done through the iris, a destruction of the iris is sure to occur with the subsequent displacement of the pupil. It is probable that in a case of this kind some other form of therapy should be considered.

Discussion. Dr. Gail Soper said that Dr. Zeiss's method of applying electrocoagulation with needles through the cornea is an ingenious one and seems to have been successful. (When Dr. Zeiss was a resident at Cook

County Hospital, he obtained some good Kodachromes of the eye, using an old Graflex camera and the considerable ingenuity needed at that time with the materials available.) If recurrences should develop in these cases which he has presented, he will undoubtedly work out a clever solution for the problem.

Two papers on this subject by members of this society are interesting: Dr. Derrick Vail reported in the 1935 *Transactions* of the American Ophthalmological Society on epithelial downgrowth in the anterior chamber following cataract extraction, arrested by radium treatment.

The second paper, by Dr. Georgiana Theobald and Dr. Joseph Haas, was presented at the 1947 meeting of the academy. They dedescribed the findings in 75 eyes which had been enucleated following cataract extraction, over a period of 10 years, at the Illinois Eye and Ear Infirmary. Twenty percent of these eyes were found to have epithelial downgrowth. Another interesting report was given by Dr. Charles Perera in the 1947 academy *Transactions,* which includes work on experimental animals.

I have seen this year a patient who had a traumatic cyst in the anterior chamber in 1934, at the age of 10 years. While tying a knot in a rope, the rope broke and his thumb struck his left eye, causing a five-mm. perforation along the limbus at the 10-o'clock position with prolapse of the iris and cataract.

The prolapsed iris was excised and a conjunctival flap was pulled over the wound. Twenty-one days later a cyst of the iris was noted near the wound area, and it continued to increase in size. In another three weeks, the tension was 40 mm. Hg (Schiøtz), and the boy was having headaches daily.

A second operation was performed 60 days following the injury. An incision was made in the former wound area and some of the iris and base of the cyst pulled out and excised. Recovery was uneventful and the tension of the eye is normal at this time, 15 years later. The cataract still remains and he has good light projection.

The diagnosis of these cases is sometimes extremely difficult and in some instances recurrence takes place after a considerable length of time.

We are indebted to Dr. Karl Scheribel for these excellent Kodachromes of illustrations in Vogt's *Atlas:*

1. Multiple cysts of iris three months after eye was kicked; several operations, but eyeball was later lost and sympathetic ophthalmia developed after going elsewhere.

2. Wood-chopping injury with excision of prolapsed iris. Two-and-one-half years later posttraumatic iris cyst shrunk by application of total of 330 r X-rays but recurred five years later. X-ray therapy failed the second time, but a good result was obtained with electrocoagulation diathermy.

3. Iris cyst developing three months following cataract extraction was grasped and excised but recurred a few weeks later and the patient refused further treatment.

4. Postoperative traumatic cyst in patient aged 33 years; round-pupil extraction with detachment of retina later and iris cyst. Eye was blind and was enucleated.

5. This is a patient, aged 40 years, with a large iris cyst which developed with no history of trauma. There was considerable pain, and no improvement with X-ray treatment. An incision with drainage of fluid and removal of cyst and iris was followed by recurrence. Vogt wished to use electrolysis, but the patient had so much pain that he asked for enucleation.

Dr. Derrick Vail congratulated Dr. Zeiss on an ingenious method of tackling a most serious problem successfully. A cyst that has not recurred in a year or two after its destruction by his method should certainly be considered a cure.

From my experience and in reading the literature in preparation for the paper mentioned by Dr. Soper, it would seem that very few of these cysts were successfully cured.

The methods in those days, as Dr. Soper said, consisted of X-ray therapy, radium treatment (especially to the down-growth of epithelium, and also to the pearl cyst arising from the iris or ciliary body), the evacuation of the cyst with a fine needle, and injection of some cauterizing substance such as tincture of iodine or other necrotic material —formaldehyde has been used, for example.

One can imagine the serious reaction that would occur from injection of that substance directly into an iris or anterior-chamber cyst of this kind. Those who have seen sections under the microscope will recall that the epithelial lining is an exceedingly thin membrane, consisting of one or two columns of epithelial cells of embryonic nature.

The only cyst of this type I have had in my practice was in a young girl, injured in an automobile accident, who had a traumatic cataract which was removed, followed some time later by development of one of these cysts from the ciliary processes.

The cyst was removed by keratome incision with loss of vitreous; fortunately it healed kindly and for six months it looked as if everything were all right. Then it recurred, another attempt was made, also partly successful for the time being; then it again recurred, and I understand that the eye is totally blind and, because of pain, will probably have to be removed.

Therefore, from personal experience and observation, as well as knowledge of the literature, I can say that outside of the cases reported tonight and that by Vogt in his *Atlas*, there are no true successes reported in the literature. For that reason Dr. Zeiss deserves commendation, and we are grateful to him for presenting this ingenious method.

During Dr. Zeiss's description of the technique, probably everyone had the thought of devising, at least mentally, some method of insulating the needles as they go through the cornea and preventing the corneal scars that are the natural sequelae of the burn from the electric current. It should not be too difficult to insulate the needle with lacquer, or perhaps put in a lacquer tube with the needle inserted through the lumen of the tube into the anterior chamber.

So far as epithelial downgrowth following cataract extraction is concerned, this is not quite pertinent to the discussion because the conditions are not the same. Although it is true the epithelial downgrowth is called an anterior-chamber cyst, the etiology is different and the development of downgrowths is quite dissimilar.

In the first case shown by Dr. Zeiss, in which the cyst was directly at the site of removal of the foreign body, I think that without question the cyst arose as the direct result of surgical intervention. In order to develop downgrowth of epithelium two things are necessary: (1) A wound that will not heal or, in other words, the lips of the wound are held separated by some substance such as a piece of capsule; (2) that a piece of epithelium from the conjunctiva, new cells from the conjunctiva, be inverted into the anterior chamber like an inverted tongue.

Even under those considitions an anterior-chamber cyst of the downgrowth of epithelium type will not develop in all cases, as has been shown by experimental work, particularly by a Japanese author a number of years ago. There seems to be an unknown quantity—a factor X—that is necessary before downgrowth of epithelium takes place, at least from the experimental viewpoint. Just what this "factor X" is, is still a mystery, but the fact remains that it is exceedingly difficult in the experimental animal to produce a downgrowth of epithelium.

As you will recall from the excellent paper by Dr. Theobald and Dr. Haas at the academy meeting, their idea of the prevention of the downgrowth of epithelium, which, incidentally, is quite rare, was the formation prior to the section in cataract operation of a large conjunctival flap that would cover the wound. So far as I know not many surgeons have carried this out, for the reason, I think, that this type of case is exceedingly rare.

To be sure, 14 percent of a number of pathologic specimens is high, but do not forget that there are not many aphakic eyes, thank goodness, that end up in a bottle in the laboratory. So the true percentage of incidence is, I am sure, a small one, perhaps less than one tenth of one percent.

The development of the iris cyst, on the other hand, is a true implantation cyst through a small wound of some sort such as a needle puncture and the same circumstances as in cataract extraction do not hold —that is (1) The lips of the wound are held apart permitting conjunctival epithelium to migrate into the anterior chamber; (2) there is not a characteristic hypotony; and (3) free epithelial substance is implanted into substance where epithelium is already present, such as epithelium in the iris or the ciliary body.

Electrocoagulation of downgrowth of epithelium, in contrast with a true cyst, would, in my opinion, not be successful. The recognition of these cysts by slitlamp examination is, in my experience, very difficult—I am speaking of downgrowth of epithelium. Pearl cysts are quite easy to recognize as you saw from the beautiful pictures from Vogt's *Atlas* which Dr. Soper showed. I am sure none of us would have any difficulty in recognizing them.

There are certain criteria that will help in the recognition of epithelial downgrowth. One is that the edge of the suspected downgrowth must be irregular, dense, gelatinous, highly refractile in its border; second, that there must be some new vessels coming from the conjunctiva onto the membrane, between the membrane and the cornea, or in the cornea itself; third, the membrane must be reflected in hammock fashion over the pupil.

In some of these cases, little pearls of epithelium have been seen with the slitlamp which form additional evidence for the suspected diagnosis. But even in these cases one cannot be sure that one is dealing with epithelial downgrowth without microscopic examination.

Therefore, it is very difficult to evaluate treatment with either radium or X rays, and I am sure some cases that have been reported as successfully treated may have not shown true downgrowth of epithelium. On the other hand, cases that have been reported as failures are definitely failures, for those eyes end up in the laboratory because of secondary glaucoma and absolute blindness.

Dr. Edward J. Zeiss (closing): I want to thank Dr. Soper and Dr. Vail for their extensive discussion of this paper. Technically the method is not difficult. I have thought of enameling the needles to insulate the cornea and if I should have another occasion I shall try that. The boy, of course, does have a cataract which subsequently will require extraction. He also requires an iridectomy to give him a useful pupil.

Scientific program

Dr. George Guibor discussed "The surgical treatment of exotropia resulting from anterior internuclear ophthalmoplegia: A practical evaluation of some surgical techniques." (This paper was published in full in the Journal, volume 33, page 1837, December, 1950.)

Richard C. Gamble,
Secretary.

LOS ANGELES OPHTHALMOLOGICAL SOCIETY

November 3, 1949

Dr. Deane C. Hartman, *chairman*

Surgical round table

Dr. Clarence H. Albaugh, Dr. Michel Loutfallah, Dr. George P. Landegger, Dr. John P. Lordan, Dr. S. Rodman Irvine, and Dr. Orwyn H. Ellis, members of the panel, agreed that, in the presence of a functioning trephination bleb, a corneal incision for cataract extraction is the procedure of choice. Postoperative endophthalmitis and hemorrhage are the most frequent

complications in an iridectomy performed in cases of recurrent uveitis when the pupil is bound down by adhesions. If iris bombé is present, transfixation is most satisfactory.

Dr. Landegger stated that, in a diabetic patient with a cloudy vitreous and diabetic retinitis, repeated hemorrhages are the greatest threat to clarity of transplanted vitreous. Spinal fluid and saline have both been successfully used. The operative procedure for a vitreous transplant should be through a cataract incision. More hemorrhages are encountered if one uses a needle and syringe for vitreous transplant than if the more radical procedure is done.

In cases of trichiasis, in the absence of much entropion, Dr. Ellis believes the best results follow the use of the Ewing operation. He prefers this for upper or lower lids, while Dr. Loutfallah uses it for upper lids only, preferring the Flarrer skin transplantation for the lower lids. Dr. Lordan uses multiple epilations with success.

In cataract surgery, the members of the panel felt that loss of degenerated liquefied vitreous was not an indication for transplantation as might be the loss of normal sticky vitreous, but one is seldom prepared to do immediate vitreous transplantation. Dr. Irvine believes that, in cataract extraction with vitreous loss, the iris sphincter should be cut at the 6-o'clock position, unless one can clear the angle and wound of vitreous with a lacrimal probe, as suggested by Dr. Jack S. Guyton.

The use of a stylet or silkworm gut or a Bowman probe firmly sutured in place was the method agreed upon to repair a "tin-can" tear of the inner canthus with a cut across the lower canaliculus.

Cosmetic reasons were the only indications for removal of a large pinguecula. A simple excision is the procedure of choice.

Unilateral congenital cataracts should not be operated upon since eyes with these are usually diseased. In adults with unilateral cataracts, if the patient is found able to tolerate a corneal lens, he is operated upon.

All members of the panel were opposed to total removal of a dislocated lens in Marfan's syndrome. A needling of some type is more successful. If a dislocation has caused glaucoma, the lens is removed directly with the loop.

For retrobulbar alcohol injection, the members of the panel suggested 1 or 2 cc. of 90- or 95-percent alcohol with a two-cm., 25-gauge needle, after first injecting one cc. of procaine. One must be certain of the pathologic condition, since the incidence of tumor in eyes with absolute glaucoma is high. One panel member utilized alcohol injection for absolute glaucoma and cyclodiathermy for hemorrhagic glaucoma. Use of both alcohol and cyclodiathermy for uncontrolled glaucoma was also suggested.

General anesthesia is recommended in cataract surgery for apprehensive adults and all children. Sodium pentothal is dependable, provided precautionary topical anesthesia of the pharynx is performed preoperatively, in the event that an airway is needed.

Orwyn H. Ellis,
Recorder.

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OPHTHALMOLOGICAL INSTRUCTIONS TO NONMEDICAL GROUPS

Many ophthalmologists have used the old adage "a little learning is a dangerous thing" as an excuse for opposing the dissemination of their special knowledge to nonmedical groups, contending that these may use such information as they retain, distorted by lack of background as it may be, for their own advantage and to the detriment of others.

Medical teaching is, however, quite contrary to this idea since it embodies the principle that the broader our knowledge of general medicine and surgery, the better will we practice our specialty. We do not often hear the idea expressed that because ophthalmologists have some general surgical training there is danger that they will attempt to perform general surgery and that, therefore, they should not be taught the principles of general surgery.

It seems reasonable that a similar thought should apply to nonmedical refractionists.

Since on them, who perform more than two thirds of the refractions in this country, rests a great responsibility for differentiating patients with disease from normal patients desiring refraction, it is important that those trained in ophthalmic pathology should give instruction in this subject.

The acceptance of some general principles are necessary for the development of most theories. Perhaps there won't be serious objection to the assumption that it is desirable that everything possible should be done to conserve and improve vision. Many special fields are involved in this, such as opthalmology, optometry, and opticianry, to which must be added some less direct activities, such as nursing and social service. If one agrees that these specialists are all contributors to visual care, the conclusion that these groups should attempt to be mutually helpful toward aiding and preserving vision seems inescapable.

Unfortunately, for one reason or another, many ophthalmologists do not accept this idea and have bitterly fought coöperation and the giving of instruction by ophthalmologists to those not medically trained who give definitive ocular care.

Resolutions passed by the Section on Ophthalmology of the American Medical Association had largely been "thou shalt nots" when, in 1941, a group of liberals introduced a resolution rescinding these restrictive statues. This passed the Section on Ophthalmology, but was presented too late for action by the House of Delegates of the American Medical Association in that year.

The losers contended long and bitterly that they had had no forewarning of the proposed change and that it was railroaded through by its advocates in a packed house. They further stated that they were prepared to introduce a contrary motion at the business meeting of the section in 1942. Since the business meeting was scheduled to precede an afternoon scientific program, which would obviously be ruined by a heated and prolonged business meeting, the chairman agreed to hold a special meeting with announcements of it in advance by postcard to every active member of the section to assure a fair chance for a representative vote. This meeting was held at Atlantic City and in a close vote the motion to rescind was itself rescinded and the status quo of the original "thou shalt nots" remained unchanged.

The whole situation was absurd in that only those so-minded had paid any attention to the restrictive legislation. In spite of regulations to the contrary, many ophthalmologists taught optometrists and lectured at their meetings and no disciplinary action was ever taken. Two Class-A medical schools were parts of universities which included schools of optometry. Professors of ophthalmology, who were members of the Ophthalmological Section of the American Medical Association, were teaching in these schools. Furthermore, optometrists were employed in departments of ophthalmology and in private doctors' offices.

Realizing the absurdity of the situation and feeling strongly that the care of vision extended far beyond the possibility of care by ophthalmologists alone, in 1946, at a well-attended business meeting of the Section on Ophthalmology, a resolution permitting the instruction of nonmedical groups by ophthalmologists was introduced and passed unanimously.

It has been the policy of the House of Delegates of the American Medical association to accept recommendations of the sections in matters such as this. Unfortunately, the usual custom was not followed in this case and the action of the section was not supported. The most likely explanation for this is that at the meeting of the committee, at which such resolutions are considered, there were no interested parties to speak in behalf of the section's action. The reason for the failure to attend the committee meeting was probably a lack of understanding of the advisability of doing this and of procedure in the House of Delegates in general. In this year's meeting there was

no slip-up and the resolution was passed.

So at long last, ophthalmologists may teach optometrists without violating the rules of the American Medical Association. It is to be hoped that this reasonable action will be final.

Since some of the previous failures to get the wished-for action were possibly due to lack of understanding of House of Delegates procedures by the section members, it might be advisable to take 15 minutes of section business time to have the section delegate present this subject to the members.

Congratulations to the officers and members of the section for this justifiable and important action, which is in line with modern thought that the dissemination of medical information is an important function of the physician! Lawrence T. Post.

HOME STUDY COURSES

Graduate medical education in the clinical specialties came into full bloom in the early twenties. It came about through evolutionary processes in the adjustments of the undergraduate curriculum in four-year medical schools. There just was not time enough for special clinical instruction in the various specialties and for new subjects in basic sciences thought to be necessary for adequate preclinical instruction for the general practice of medicine and surgery. The addition of another year to the four-year curriculum was contemplated but not adopted. Instead, some subjects were removed from the medical to the premedical program and bedside training was relegated to the interne year which must be completed to earn the M.D. degree.

In the undergraduate school, instruction in the clinical specialties was reduced to a few hours. In a few institutions provision was made for graduate students in some specialties by creating residencies, assistantships, and scholarships in the hospital clinics whereby further instruction in special practice could be obtained. There was no specific curriculum in graduate medicine; one was free to set himself up as a specialist whenever he felt he was sufficiently trained.

For an ophthalmologist, several months in European eye clinics were considered adequate. Then came the boards. Sponsored by the three national ophthalmological societies, the American Board for Ophthalmic Examinations was organized and held the first examination in Memphis, Tennessee, in 1915. In the next 25 years, the requirements for certification of an ophthalmologist were established by the experience of the board, and the present requirement of three years of postgraduate study has been accepted in all medical centers.

A curriculum has not been made, but one is in the making. The board examinations were comprehensive. They covered most all of the premedical, medical, and surgical aspects of ophthalmology. Candidates for board certification were advised of the scope of the examinations and told that three years of study in residencies or equivalent positions would be required to meet the tests. The candidate was left to his own devices. No two schools or hospitals had comparable services. Few had an adequate teaching staff or physical facilities for advanced training. There was little that the board could do about it. The board was a screening agency, not a teaching body.

In 1940, the American Academy of Ophthalmology and Otolaryngology launched the Home Study Courses in ophthalmology and otolaryngology. Designed primarily to aid the resident, it established monthly reading courses in most of the subjects covered by the boards and followed up by giving a written test on the month's reading. The courses have not exceeded one academic year and are open to any qualified graduate of medicine.

It is estimated that more than 50 percent of the candidates who have taken the examinations of the boards in the past 10 years have taken the Home Study Courses. Besides the recent graduates who are candidates for certification by the boards, men who have been in practice for several years subscribe

to the courses as the most effective way of brushing up on fundamentals and keeping up-to-date on clinical advances. In practically all of the medical schools of North and South America the courses of study provided by the academy are employed in laying the groundwork in graduate instruction.

On the Home Study Courses faculties are most of the members of the ophthalmologic and otolaryngologic boards who also are members of faculties of our outstanding medical schools. Such close coöperation could only result in mutual improvement in methods of teaching, in the quality of instruction, and in raising of standards throughout the land. Textbooks and current journals are supplemented by specially produced manuals designed with the understanding that they may be obsolete in two to three years, so they must be as up-to-date as the latest published review.

The American Board of Ophthalmology had the key to the greatest advance in mass medical education since the four-year curriculum was established in medical schools. The Home Study Courses of the Academy are in the process of being so correlated that they now contribute a flexible uniform course of graduate study in ophthalmology and otolaryngology, with the result that in these specialties the standards of practice are second to none.

William L. Benedict.

CORRESPONDENCE

Keratitis with deafness

Editor,
American Journal of Ophthalmology:

Donald and Gardner's article, "Keratitis with deafness," (Am. J. Ophth., **33**:889, 1950) presents some interesting problems which are worthy of more than passing comment. Although they have tried to perpetuate the syndrome of keratitis and vestibuloauditory symptoms of nonluetic origin, seemingly satisfied that the syndrome is nonluetic, it nevertheless seems unreasonable to continue to stress this nonluetic phase when there may be so many other etiologic factors capable of producing this syndrome. It is like saying a condition is a gastroenteritis of nontyphoid etiology.

In a recent paper (Arch. Ophth., **41**: 24-31, 1949) this grouping of symptoms was shown to appear 7 to 10 days after vaccination. It was not the purpose of that paper to show that this syndrome specifically followed vaccination against smallpox. Vaccination with its specific immunologic response is illustrative of the mechanism producing this syndrome especially when appearing after a very specific incubation period. Subsequent studies (Ophthalmologica, **115**:321-332, 1948; Arch. Pediat., **67**: 1-7, 1950) served to show how related complications could appear after exposure to other viruses.

If symptoms of neurologic nature appear after a very specific incubation period following exposure to viruses of contagious diseases, there is usually present an atypical encephalomyelitis. In Donald and Gardner's case there is little doubt that the syndrome suggests an atypical encephalitis. In such instances surgical intervention seems to be a dangerous procedure for several reasons, not least among which is the introduction of trauma in an already supersensitive host. Robson (Arch. Ophth., **44**:243, 1950), in a recent paper rightfully condemned such a surgical procedure.

It appears that antibiotics as well as anesthetics are of doubtful benefit in such instances since these substances act as added allergens. This hypersensitive state probably developed in one of Cogan's cases (quoted by Donald and Gardner) in which the unexplained 30-percent eosinophilia may have been a manifestation of the hyperergic state which followed "over medication" with antibiotics. In Donald and Gardner's case the initial upper respiratory infection (in July) was the sensitizing attack. The reactive attack occurred in November with the neurologic manifestations appearing one week later.

The blood count is usually of importance;

the cell type changing very definitely with the chronicity of the illness. A reported "count within normal limits" is misleading. The inoculation of spinal and other fluids into laboratory animals produces a non-related entity (J. Path. & Bact., **33**:463, 1930) differing entirely from the original disease. X-ray therapy may be of some value early in the disease, but is apparently of no help in the chronic phase.

The purpose of this communication is to endeavor to show that the etiology of the syndrome of deafness and interstitial keratitis is viral. Once having recognized this etiology the treatment becomes important particularly in avoiding certain procedures. The patients seem to fare much better when the treatment is less dramatic and not experimental.

(Signed) Emanuel Rosen,
Newark, New Jersey

REPLY TO DR. ROSEN

Editor,
American Journal of Ophthalmology:

Thank you for forwarding Dr. Emanuel Rosen's letter. I find it quite interesting from several viewpoints. Initially, I might state that the patient was treated and the case report prepared for publication prior to the publication of Dr. Rosen's articles. I fail to see, however, that the course of treatment would have been altered, since no original therapy has been offered by Dr. Rosen.

That the etiologic factor might possibly be viral in character is by no means new since Cogan (Arch. Ophth., **33**:144-149, 1945) before 1945 was working along such lines. Our animal studies were undertaken after consultation with the department of pathology of the Cleveland Clinic and the virus laboratory of Western Reserve University. It was felt that by such investigation a factor might possibly be isolated against which more specific therapeutic measures could be directed.

The patient was treated with all of the antibiotics and supportive measures known at that time, in addition to X-ray therapy to the head. The authors of the only cases presented in the literature at that time, Cogan, and Mogan and Baumgartner (West. J. Surg., **42**:628, 1934) were consulted concerning treatment of the case. In addition, the patient was presented at joint staff meetings of the neurology and neurosurgical departments. His case was followed by the members of the E.N.T., eye, medical and X-ray departments. In 1934, Mogan and Baumgartner reported such a case which they felt was markedly relieved by cervical sympathectomy.

In summary, we had a young man with advanced keratitis and rapid loss of hearing. One would have expected his course to follow that of practically all of the cases to total deafness, the remarkable exception being Mogan and Baumgartner's case.

In view of the unsatisfactory response to other therapeutic measures, it was decided that the problem should be presented to the patient and his family. This was done, and it was stressed that the procedure might very possibly not relieve the symptoms and that it had been tried in only one case. Under those conditions the cervical sympathectomy was performed. Whether the return of hearing was initiated or aided by the operation is indeterminable, but we have all been encouraged thereby, and also by his subsequent course.

(Signed) R. A. Donald,
Fresno, California

BOOK REVIEWS

EYES AND INDUSTRY. By Hedwig S. Kuhn, M.D. St. Louis, C. V. Mosby Company, 1950. 378 pages, 151 illustrations. Price: $8.50.

Dr. Kuhn has collected in this book a comprehensive statistical and medical report of the literature on file with the Joint Committee of Industrial Ophthalmology. To this literature she has added her own observations and opinions.

The first four chapters pertaining to visual testing, skills, standards, and corrective

programs are idealistic but do form a definite program of progress toward which the safety engineer and the ophthalmologist may work.

Chapter five was contributed by Dr. Albert C. Snell and is written in his own inimitable style. This chapter covers eye injuries caused by solid bodies in minute detail and should be required reading and practice by all ophthalmologists doing industrial work.

Chapter six concerns radiation injuries and is an excellent summary of all data published to date concerning this serious and painful form of injury.

Chapter seven deals with chemical eye injuries and here the author has allowed her enthusiasm over a new drug to bias her opinion. The implication in this chapter is that hydrosulfosol has the uncanny magic of rapidly curing any and all types of chemical burns. On page 231, strict adherence to the basic principle of denuding is advised as the first step; yet under procedure on page 232, this important step is notably missing. Chemical burns, after all, do have individual characteristics and their treatment should be more individualized than the author has indicated.

Eye protection and illumination are well covered in chapters eight and nine and these two chapters provide an excellent handbook for guidance in approaching these problems.

Dr. Kuhn is to be commended on her treatment of the problem of the blind in industry. It certainly is a step toward rendering obsolete the criticism of Dr. Meyer Wiener that "more has been written about the problem of the blind and less done about it than any other subject."

Under the headings of miscellaneous and appendix there is a wealth of information touching all of the subjects of interest to the industrial ophthalmologist.

Of particular value in this book are the complete lists of references on every subject, compiled at no small effort. The possessor of this book practically has a *Cumulative Index* at his hand in so far as industrial ophthalmology is concerned.

A well-done index completes this fine book.

Ralph S. McLaughlin.

SOME RELATIONS BETWEEN VISION AND AUDITION. By J. Donald Harris, Ph.D. Springfield, Ill. Charles C Thomas, 1950. Clothbound, 56 pages, including bibliography. Price: $1.50.

The eyes and ears both collect and sort out impinging stimuli, and though they are derived from different germ layers and handle quite different spectra, the functional organization of the auditory and visual nervous systems is similar. In both organs, sensitivity is almost at theoretical limits. Neither ever produces true zero sensation. In the absence of an external stimulus the eye reports idioretinal gray, and external signals register over the background of this sensation.

Both organs can briefly tolerate an enormous variation in intensity. Visual adaptation has its counterpart in auditory fatigue. In both vision and audition, the Weber fraction varies with the intensity of the stimulus. For both senses duration approaches zero with infinite intensity. The critical flutter frequencies of noise may be compared with their analogue in vision.

Pitch discrimination shows a smooth decrease from high to low frequencies, but hue discrimination is best at 485, 575, and 625 millimicrons, as might be expected with three color receptors present—each with a different brightness distribution. The auditory system does not show the diversity of nervous action found in the retina and optic nerve; and in comparison to the retina, the histology of the cochlea is simple.

This scholarly and stimulating dissertation indicates that certain general principles characterize the organization of the whole sensorium.

James E. Lebensohn.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

5

DIAGNOSIS AND THERAPY

Alvaro, M. E. **Treatment of ocular disease with Beta rays of radium.** An. Soc. mex. de oftal. **23**:117-128, July-Sept., 1949.

The nature of these rays, their action upon the tissues, their relative harmlessness, and the advantage of their use to prepare for corneal transplantation are discussed. The necessary applicators are described. W. H. Crisp.

Alvis, B. Y. **The role of hyperpyrexia in the treatment of ocular disease.** Tr. Am. Ophth. Soc. **47**:384-442, 1949.

From an analysis of 128 cases of ocular disease treated by hyperthermia and from a very complete review of the literature, the author concludes that foreign protein therapy, protein shock therapy and physically induced hyperpyrexia derive their beneficial effects by their common factor of acceleration of body defense reactions. Foreign protein injections are effective in proportion to the degree and duration of fever. Hyperpyrexia alone, as induced by physical means, will accelerate all of the body's defense reactions more effectively than pyretogenic injection and is more effective and safer. Hyperpyrexia is of great value in the treatment of many ocular diseases, especially those in an exudative stage.

David Harrington.

Berens, C., and Tolman, C. P. **An ocular hypertension indicator (tonometer).** J.A.M.A. **142**:1360, April 29, 1950.

A small compact instrument with which general practitioners can determine whether ocular tension is above or below normal is described. It is a "screening" rather than a diagnostic instrument and its simplicity eliminates many complicated parts of the standard Schiøtz tonometer. Its use will lessen reference of suspected glaucoma patients to the ophthalmologist. The instrument, mounted in plastic holder, easily adjusted, is equipped with an optically magnified reading scale and indicator, for use in either lateral or vertical position. Hope is expressed that ophthalmologists will test this instrument for screening, with a view to making it available to general physicians in their routine work, and that this may result in prevention of much unnecessary blindness. C. L. LaRue.

Chamlin, M., and Davidoff, L. M. **The 1/2,000 field in chiasmal interference.** Arch. Ophth. **44**:53-70, July, 1950.

The 1/2,000 field is the earliest to show initial chiasmal interference as well as extension of existing interference, and the last to lose evidence of such interference. Even when a peripheral defect is present in a case of chiasmal interference, the 1/2,000 field will always show at least as much, and usually much more, defect. The 1/2,000 field for white is much more accurate and reliable than any of the fields for colors in following the progress of chiasmal interference. The 1/2,000 field will show important evidence of increased or decreased chiasmal interference long before central visual acuity shows any change. The term "intermediate field" is introduced for the area between 10 and 25 degrees.

R. W. Danielson.

Coqui, Carlos. **Orbital radiology.** An. Soc. mex. de oftal. **23**:230-242, Oct.-Dec., 1949.

Anatomy and radiographic peculiarities of the orbit are reviewed, and a special section deals with radiologic diagnosis in diseases of the orbit. W. H. Crisp.

Deo Ridruejo, J. M. **The surgical use of a razor blade.** Arch. Soc. oftal. hispano-am. **10**:759-766, July, 1950.

The author uses a fragment of a razor blade as a substitute for a Graefe knife, keratome and scissors in making the scleral incision in cyclodialysis, an ab externo incision into the anterior chamber, and in completing the section of the graft in keratoplasty. (6 figures)

Ray K. Daily.

Dolcet Buxeres, Luis. **Filatov's tissue therapy in myopia.** Arch. Soc. oftal. hispano-am. **10**:604-610, June, 1950.

A tabulated report of 55 cases of myopia greater than 8 diopters, treated with subconjunctival implantation of placenta according to Filatov, shows that vision improved more than 0.6 in 12 cases, more than 0.3 in 25 cases and more than 0.1 in 16 cases. Ray K. Daily.

Dunnington, J. H., and Regan, E. F. **Late fistulization of operative wounds: diagnosis and treatment.** Tr. Am. Ophth. Soc. **47**:63-79, 1949.

The signs and symptoms of slow or intermittent leakage of aqueous are characteristic. Lacrimation, blurred vision and hypotony, all of which may be intermittent, are most suggestive of fistulization even though the anterior chamber is normal in depth. The fluorescein test is not always positive and repeated examinations may be necessary to establish the diagnosis. Cure may be effected by prompt treatment. The method of choice is a combination of cauterizing the opening, suturing its edges and covering it with a conjunctival flap.

David Harrington.

Ferrata, L., and Calamandrei, G. **Action of the corticotropic hormone in ophthalmology.** Ann. di ottal. e clin. ocul. **76**: 189-192, June, 1950.

The authors report six cases of iritis and three of episcleritis, all presumably rheumatic, treated with daily injections of the hormone of the anterior pituitary which acts on the adrenal cortex. An extract equivalent to 1 Gm. of fresh organ was used, and vitamin C in doses of 500 mg. was injected concomitantly. Local treatment consisted of atropine and dionin. Subjective symptoms were much lessened, or even disappeared, on the first day of treatment, and the circumcorneal injection on the fourth or fifth day. Other signs, particularly the precipitates on Descemet's membrane, disappeared in the third week, when the clinical cure was usually complete. Studies made on normal subjects indicate that the hormone in the

dosage used has no appreciable effect on the ocular tension and retinal arterial pressure. It can be said that the corticotropic hormone is vastly superior to any form of therapy used hitherto.

Harry K. Messenger.

Goldschmidt, Max. **A new test for function of the macula lutea.** Arch. Ophth. **44**:129-135, July, 1950.

Haidinger's brushes is the name of a phenomenon due to the dichroism of the macula lutea of the retina, particularly of Henle's layer. Haidinger's brushes can be recognized by all persons with normal eyes regardless of age and sex. All kinds of ocular anomalies and diseases of the eye in which there is participation of the macula lutea, especially Henle's layer, can be detected in the very early stages of the disease. R. W. Danielson.

Gundersen, T., and Bietti, G. B. **Experimental and clinical investigations on para-amino-salicylic acid (PAS), alone or in association with streptomycin in ocular tuberculosis.** Tr. Am. Ophth. Soc. **47**:276-300, 1949.

The author reports rather extensive experimental and clinical use of PAS in ocular tuberculosis, both alone and in association with streptomycin. Its action is compared to that of streptomycin alone and to the sulfones. He concludes that, while it is too early to properly evaluate results, the combination of PAS and streptomycin may be much more effective than the hitherto employed means of therapy, including the sulfones. Rather high levels of the drug may be maintained in the aqueous by iontophoresis. Continuance of classical antituberculosis therapy in conjunction with PAS is advocated. David Harrington.

Haik, G. M. **Beta irradiation in ophthalmology.** New Orleans M. and S. J. **102**:504-514, April, 1950.

The author discusses and describes his method of using Beta radiation in the treatment of corneal vessels, vernal conjunctivitis, and scleritis. In addition, although the series is small and the time of observation relatively short, good results are reported with the use of Beta radiation in the treatment of certain types of glaucoma. Donald T. Hughson.

Henderson, J. W., and Hollenhorst, R. W. **Effects of cortisone on certain ophthalmic diseases.** Proc. Staff Mtgs. Mayo Clin. **25**:491-492, Aug. 16, 1950.

When cortisone was administered relatively early in the course of ocular disease associated with rheumatoid arthritis, the inflammation responded promptly. One patient was able to undergo surgery for acute glaucoma in the course of a uveitis. Cortisone did not cause absorption of synechiae or long standing keratic precipitates. Cortisone did promote absorbtion of postinflammatory vitreous opacities and cells in the aqueous. In one case acute choroiditis definitely resolved with the use of cortisone. The drug relieved the symptoms of vernal catarrh; the papules resolved somewhat, but the symptoms returned as soon as use of the drug was discontinued.

Irwin E. Gaynon.

Hurwitz, P. and Thompson, J. M. **Use of naphazoline (privine) in ophthalmology.** Arch. Ophth. **43**:712-717, April, 1950.

Naphazoline hydrochloride, in 0.1-percent solution, was found to have a prolonged decongestant effect on the superficial cornea and the palpebral and bulbar conjunctiva. It reduced ocular hyperemia in cases of chronic catarrh, allergic and vernal conjunctivitis, keratitis due to any of many causes, chronic iridocyclitis and postoperative states. This response was facilitated by the rapid and striking contraction of the superficial conjunctival and corneal capillaries. Only a small per-

centage of eyes showed any significant increase in intraocular pressure after using the drug. The mydriatic effect is very mild and is limited almost entirely to lightly pigmented irides. Naphazoline is well tolerated and is advocated for use in conditions in which ocular decongestion is desirable. John C. Long.

Kahn, E. A., and Cherry, G. R. **The clinical importance of spontaneous retinal venous pulsation.** Univ. Michigan M. Bull. **16**:305-308, Oct., 1950.

The neurologist can infer that his patient does not have an intracranial pressure of over 200 mm. of water if there is spontaneous pulsation of the retinal veins. The pulsation can be stopped by jugular compression and is probably brought about by retarding the retinal venous return when the intracranial pressure is raised rather than by direct interference with the retinal venous return through the jugular veins.

Only about 50 percent of patients have spontaneous retinal venous pulsation normally. Its presence indicates normal intracranial pressure but its absence is not a sign that intracranial pressure is elevated. H. C. Weinberg.

Lippman, Otto. **Use of adrenal cortical hormone in inflammatory eye diseases.** Texas St.J.M. **46**:708-710, Sept., 1950.

The treatment in inflammatory conditions of the eye by adrenal cortical hormones is briefly discussed. A case of bilateral chronic uveitis, three and one-half months after cataract extraction, resembling a granulomatous type of uveitis and suggesting sympathetic ophthalmia, is reported, and its successful treatment with Cortone is described.

Theodore M. Shapira.

Lubkin, Virginia. **Photography of the red reflex.** Arch. Ophth. **43**:718-719, April, 1950.

The author describes the use of the Nordensen fundus camera to photograph the red reflex. In this manner opacities of the media may be accurately portrayed by photographing the silhouette in a transilluminated field. (6 color photographs) John C. Long.

Maione, Mario. **A new apparatus for biomicroscopic examination of iridocorneal angle, retina, and vitreous.** Ann. di ottal. e clin. ocul. **76**:185-188, June, 1950.

Maione describes a new contact glass which makes the technique of gonioscopy very simple. It is essentially a modification of Goldmann's gonioscope, over which it has six advantages. 1. It has four reflecting surfaces instead of one. 2. No prism is required for reducing the angle between incident and reflected light. 3. The iridocorneal angle is illuminated directly. 4. No fluid is required between the glass and the eye. 5. A little soap is all that is required to prevent steaming or clouding. 6. Since the contact glass touches only the cornea it can be used for goniotomy. The apparatus consists of a four-sided glass pyramid with a flat base and a truncated apex which is rounded to fit the cornea. The inclination of the four faces of the pyramid is such as to permit total reflection of both incident and emergent light. Supplemented by a glass cube consisting of two right-angled prisms joined by their hypotenuses the apparatus can be used with any kind of slitlamp for examining retina and vitreous. (1 figure)

Harry K. Messenger.

Marucci, Luigi. **Modification of Comberg-Borsati method of localization of intraocular foreign bodies.** Rassegna ital. d'ottal. **19**:285-292, July-Aug., 1950.

First one determines any deviation of the visual axes. Then a narrow metal ring with 8 perforations at 10-degree intervals is attached to the perilimbal region. The

principal openings in the ring must correspond to 0, 10, 180 and 270-degree positions. Antero-posterior and lateral X-ray films are made and are superimposed in a special viewing box if possible. (4 figures) Eugene M. Blake.

Means, J. H., and Stanbury, J. B. **Clinical orbitonometry.** Am. J. M. Sc. **220**:357-361, Oct., 1950.

An instrument is described which enables one to measure the orbital resistance. This is helpful in determining the course of Graves' disease. Orbital resistance is increased in the active phase of the ophthalmopathic type, diminished in the inactive phase, and little changed in ordinary types of Graves' disease.

Essentially the instrument provides a means of pressing a contact lens against the eye with a dynamometer. An adjustable bridge is fitted to rest against the outer angles of the orbit and the nose. Pressure readings are taken and recorded in grams. The distance between the eyeball and the bridge also can be read directly from the dynamometer.

H. C. Weinberg.

Miles, P. W. **Flicker fusion fields. III. Findings in early glaucoma.** Arch. Ophth. **43**:661-677, April, 1950.

The eyes of 24 subjects with normal visual acuity and fields but in whom the diagnosis of early glaucoma was reasonably well established showed defective flicker fusion frequencies. Apparently, in diseases affecting visual perception, the latent period following a stimulus and the duration after the stimulus and response of the inhibitory period combine to reduce the flicker fusion frequency before acuity and form vision, and possibly light thresholds, are affected. Flicker fusion frequency is a phenomenon well suited to tests of perception in the diagnosis of diseases of the retina and optic tracts. John C. Long.

Ojeda Lazaro, Emilio. **Methyl antigen in scrofulous ocular lesions.** Arch. Soc. oftal. hispano-am. **10**:375-379, April, 1950.

The author used methyl antigen with excellent results in 160 cases of phlyctenular keratoconjunctivitis, and 60 cases of styes, chalazia and blepharitis of scrofulous nature. The results were particularly good in cases uncomplicated by secondary infections. In styes, chalazia and blepharitis the results were less decided because of the associated staphylococcus infection and autovaccines were added. Methyl antigen rarely causes focal and general reactions; a mild and transitory local erythema occurs occasionally.

Ray K. Daily.

Persichetti, C. **Effect of dihydroergotamine (D.H.E. 45) in ophthalmic migraine and glaucoma.** Boll. d'ocul. **29**:234-250, April, 1950.

Dihydroergotamine is a hydrated ergotamine tartrate (gynergen). Seven normal persons received intramuscular injections of dihydroergotamine and showed no change of the intraocular pressure, no definite change of the systolic and diastolic retinal arterial pressure, and, in five of seven cases, a slight drop in the brachial arterial pressure. Fifteen drops taken three times a day for four or five subsequent days produced few changes in most of the volunteers; in two persons, a very slight drop in arterial pressure and in retinal arterial pressure was registered. Nine patients with ophthalmic migraine showed different therapeutic results: two none, two good, five excellent. The drop in arterial blood pressure did not necessarily accompany the best results. Five patients with chronic simple glaucoma, 6 with chronic congestive and 3 with acute congestive glaucoma were treated. There was a decrease in intraocular pressure in 2 of the 5 patients with chronic simple, in 4 of the 6 with chronic congestive, and in none of those with acute con-

gestive glaucoma. Gynergen produced less satisfactory results when used in the same eye. (33 references)

K. W. Ascher.

Ruedemann, A. D. **Beta ray uses in ophthalmology.** Wisconsin M. J. **49**:581-584, July 1950.

Radon, after screening, consists of 97 percent beta radiation and 3 percent gamma radiation. The 10 millicurie radium D application is too weak and the treatment time is prolonged. Gamma contact X-ray or beta rays are useful in marginal epithelial overgrowth. Vernal catarrh responds to contact X-ray or to gamma rays. Corneal nebulae, leukoma, dermoids of the cornea, small pterigia, active interstitial keratitis and teratoma respond to beta radiation. Alkali-acid burns of the cornea with vascularization may be irradiated before corneal transplantation.

Irwin E. Gaynon.

Salcedo G., Mario. **Ophthalmotonography and ophthalmotonographer.** An. Soc. mex. de oftal. **23**:243-260, Oct.-Dec., 1949.

The author discusses the basic principles of ocular tonometry, including the experimental approach to the development of tonometric devices, and refers briefly to a new procedure of his own invention, which is apparently to be described more fully in a later issue of the Anales. (2 figures)

W. H. Crisp.

Salgado Benavides, E. **A report on histio-therapy.** Arch. Soc. oftal. hispano-am. **10**:890-896, Aug., 1950.

Of 30 cases of various ocular diseases treated with subconjunctival implantations of placenta there was improvement in four. In a case of retinitis pigmentosa, the visual fields increased in size; a patient with Lawrence-Moon-Biedl syndrome had an undeniable improvement and a feeling of well being; the blood became absorbed very rapidly in a case of traumatic hyphema and a patient with myopic chorioretinitis recovered within two months. (Visual fields)

Ray K. Daily.

da Silva, A. G. **Retro-trans-illumination.** Arq. brasil de oftal. **13**:77-85 (Portuguese), 86-92 (English).

A technique of slitlamp examination is described as in Berliner's volume.

W. H. Crisp.

Silvan Lopez, Fernando. **Subconjunctival injections of penicillin.** Arch. Soc. oftal. hispano-am. **10**:871-881, Aug., 1950.

The author bases his opinion on a review of the literature and his personal experience. Penicillin injected subconjunctivally is the method of choice for obtaining a continuous bacteriostatic effect in the ocular tissues. The minimum dose is 100,000 units repeated every 2 hours, or 200,000 to 400,000 units repeated every 24 hours. The most satisfactory solvent is 0.25 cc. adrenalin 1:1000 and 0.25 to 0.5 cc. distilled water or 2-percent novocain solution. The injection is extremely painful, and should be preceded by an injection of novocain. The treatment is satisfactory in all suppurative lesions caused by microorganisms sensitive to penicillin, especially in exogenous or metastatic corneal lesions, iridocyclitis and endophthalmitis. In ring-shaped keratitis, frequently produced by bacillus fluorescens or prodigiosus, penicillin should be combined with streptomycin. It should be used as a prophylactic injection in penetrating ocular injuries and after the extraction of intraocular foreign bodies. The effect of this treatment is less pronounced in uveitis of toxic and allergic origin, and in cases associated with hypertension, because in these the circulation and diffusion of the antibiotic through the ocular tissues is disturbed. In two patients the author encountered

intense local reactions, toxic or allergic in type, which subsided in a few days.

Ray K. Daily.

Suster, V. **Significance and evaluation of sedimentation of red blood cells in diseases of the eye.** Bratislavske Lek. Listy **30**:1-8, 1950.

On the basis of 265 clinical cases of disease of the eyeball and of the optic nerve and further from experiments on nine rabbits, the author concludes that the ocular disorder may cause acceleration of blood sedimentation, but that this sedimentation cannot be used for diagnosis and differential diagnosis between rheumatic, tuberculous, and luetic disease of the eye, as some declare.

W. H. Crisp.

Theodore, F. H. **Use of sodium propionate in external infections of the eyes.** J.A.M.A. **143**:226-228, May 20, 1950.

Peck, in 1939, demonstrated that human sweat is fungistatic because it contains lower fatty acids. Today derivatives of such acids are used in dermatology, gynecology, ophthalmology, otology, also in foods and in nonirritating adhesive tape. Sodium propionate, a nontoxic physiologic, antibiotic and fungicide, is of great value against the staphylococcus, an organism very resistant to antibiotics. Used in 5-percent solution it is effective in acute and chronic as well as allergic conjunctivitis. Less striking results are obtained with chronic blepharoconjunctivitis and virus keratitis, although its use after removal of corneal foreign bodies as a preventive of corneal ulcer is highly recommended. On the whole, clinical use has established without doubt the great value of sodium propionate when used in infections of the external eye and associated conditions. C. L. LaRue.

Vianna, Louzada. **Tissue therapy: biogenic stimulants.** Rev. brasil. oftal. **8**: 211-249, June, 1950.

Filatov, in 1933, attempted to improve an opacified transplant by means of cadaver cornea kept at low temperature. Usually homoplastic, rarely autoplastic or heteroplastic, transplants were employed. Homoplastic transplant of rabbit eyes was accomplished by Velter even after conservation of the donor's eye in the refrigerator for thirty days, and Bajenova was able to maintain the preservation at −25°C. Tissue extracts and drugs as well as tissues have been employed. Results obtained by a considerable number of authors are summarized.

W. H. Crisp.

Vianna, Louzada. **Tuberculin therapy in ophthalmology.** Rev. brasil. oftal. **9**: 5-12, Sept., 1950.

Vianna is impressed with the validity of the belief of Charlin and others that vague symptoms such as chronic headache and a suggested general toxic reaction should suggest tuberculosis in the absence of more positive findings, and should favor tuberculin therapy. Vianna presents a number of cases in which this idea was fruitful of results.

W. H. Crisp.

Watts, S. G., and Gleich, M. M. **Penicillin-silver nitrate prophylaxis against gonorrheal ophthalmia of the newborn.** J.A.M.A. **143**:635-637, June 17, 1950.

In 1944, the authors were successful in reducing the incidence of gonorrheal ophthalmia of the newborn from approximately ½ percent in infants treated with silver nitrate alone, to one-third of that figure by the combined use of sulfathiazole orally and local applications of silver nitrate. Now, they have studied the prophylactic effect of the combined intramuscular administration of 50,000 units of penicillin G in 1 cc. of distilled water and local application of silver nitrate. Of

4,565 newborn infants treated in this fashion during the one year period, not one case of proved gonococcic conjunctivitis was observed. No serious reactions were ascribed to the use of the penicillin.

Benjamin Milder.

Weidmann, Walter. **A self registering campimeter for comparable examinations.** Klin. Monatsbl. f. Augenh. **116**:641-646, 1950.

The author describes an automatically registering campimeter with an observation distance of one meter. (4 figures)

R. Grunfeld.

6

OCULAR MOTILITY

Burian, H. M. **Strabismus: review of the literature.** Arch. Ophth. **44**:146-154, July, 1950.

This excellent review is a survey of the pertinent literature on this subject published in 1949 and in the first quarter of 1950, and should be read in full by all ophthalmologists. R. W. Danielson.

Corrado, M. **Nuclear paralytic strabism due to Rh incompatibility in a case of icterus gravis neonatorum.** Boll. d'ocul. **29**:69-83, Feb., 1950.

A nuclear sixth-nerve paralysis developed in a 3-year-old boy at the age of two months. The diagnosis of Rh incompatibility was made and Rh negative blood transfusions were performed. Erythroblastosis improved. There was no change in the abducens paralysis. (29 references) K. W. Ascher.

Focosi, M., and Bruna, F. **Surgical treatment of upper oblique muscle paresis.** Boll. d'ocul. **29**:197-216, April, 1950.

Six patients with paresis of the superior oblique were treated by performing a myectomy of the inferior oblique of the same eye or by shortening of the superior oblique muscle. In some cases both of these operations should be performed. Tenotomy of the contralateral inferior rectus is not advisable. McLean's technique is prefered because of its folding effect and sparing of the superior rectus muscle. (15 figures, 38 references)

K. W. Ascher.

Krewson, W. E. **Diagnosis of multiple ocular muscle paralyses.** J.A.M.A. **144**: 534-537, Oct. 14, 1950.

Diagnosis of multiple ocular paralysis is far more difficult than that of a single muscle. Most useful diagnostic methods are the use of the Maddox rod and phorometer, tests of ductions, of versions and of diplopia fields and, most helpful of all, the cover test. Of less importance are head tilting and past pointing. Paralyses are followed by diplopia, limitation of movement, deviations, vertigo and dizziness but all of these change as spasticity and fibrosis develop. Underaction, a controversial subject, is confusing. Myasthenia gravis and double hypertropia may lead the diagnostician astray. Paralysis of the elevator of the upper lid and of extraocular muscles have much in common and add to diagnostic confusion. Charts listing multiple paralyses involving one eye and involving both eyes are given. C. L. LaRue.

Morone, Giulio. **Recession of internal rectus muscle in treatment of convergent strabismus.** Rassegna ital. d'ottal. **19**:250-259, July-Aug., 1950.

The author advocates the recession of the medial rectus muscle in concommitant esotropia above other measures. He accepts the fact that this procedure is applicable only in cases of not more than 20 prism diopters of convergence, unless both eyes are operated upon.

Eugene M. Blake.

Moses, R. A. **Torsion of the eye on**

oblique gaze. Arch. Ophth. **44**:136-139, July, 1950.

To determine whether or not there is torsion of the eye in oblique gaze, the author, after instillation anesthesia, and while the subject gazes ahead, makes ink marks at the limbus to identify the vertical meridian of the cornea. The subject then gazes into the observer's eye. A small plumb line is adjusted so as to bisect the subject's pupil. As the direction of gaze is shifted laterally or medially, the plumb line is shifted also. The ink marks are observed with reference to the plumb line. In oblique positions of gaze the sagittal meridian of the eye is not vertical. This meridan is turned out when the subject looks up and out or down and in. In the other two oblique directions it is turned in. The amount of torsion is of the order of magnitude predicted by Maddox on the basis of Listing's law. Afterimages turn in the same sense as the torsion of the eye itself. R. W. Danielson.

Osorio, L. A. **The problem of heterophorias.** Arq. brasil. de oftal. **13**:1-17, 1950.

Osorio cites a series of clinical cases in which the heterophoric problem was an important part of the patients' general refractive problem. W. H. Crisp.

Urrets Zavalia, Alberto. **Etiopathogenic classification of concomitant strabismus.** Arch. Soc. oftal. hispano-am. **10**: 485-516, May, 1950.

The author suggests that there are three types of concomitant strabismus, 1. the ophthalmoplegic type, due to congenital or acquired insufficiency of the ocular muscles, 2. the accommodative type, due essentially to isoametropia and 3. the anisostetic type, due to the disparity of the images of the two eyes. The three types may be encountered in pure form, and there may be border-line cases in which the disturbance is the result of several factors. The article consists principally of a comprehensive review of the literature on the pathogenesis of concomitant strabismus, and a reiteration of the author's contention that paresis of the vertical or oblique muscles is an important factor in the pathogenesis of horizontal deviations. Ray K. Daily.

7

CONJUNCTIVA, CORNEA, SCLERA

Baird, J. M. **Roentgen therapy in corneal ulcers.** Tr. Am. Ophth. Soc. **47**:443-461, 1949.

Treatment by X-ray was given in 138 cases of severely infected corneal ulcer, in most of which conventional methods had been without much success. The total roentgen dosage was usually 320 r. never more than 500 r. Prompt relief of pain was the most striking feature in these cases. In no case did perforation ensue and in none was enucleation necessary. No cataracts have developed in 60 cases re-examined eight years or more after treatment. No cataracts have been reported from the remaining 78 cases. The therapy was given in divided doses of 80 r at three-day internals.

David Harrington.

Castroviejo, Ramon. **Lamellar keratoplasty.** Ann. d'ocul. **183**:641-659, Aug., 1950.

The vision after lamellar keratoplasty is often less satisfactory than that which follows perforating keratoplasty because the former is usually employed in the least promising cases. Lamellar keratoplasty is advisable for patients who are unruly, and for opacities which either involve only the anterior layers of the cornea, or for which the successful performance of perforating keratoplasty would be very difficult or impossible. Perforating keratoplasty is usually preferable

when opacities involve especially the middle and posterior strata of the cornea.
Chas. A. Bahn.

Engel, Hans-Joachin. **Observations on corneal cysts.** Klin. Monatsbl. f. Augenh. **116**:515-521, 1950.

Corneal cysts may occur in the corneal stroma or on the anterior or posterior surface. Only the implantation cysts, cavities lined with epithelium, which develop from small scratches on the corneal surface are true cysts. Other cysts are intraepithelial cysts, vesicles or bullae. Cysts are found on the cornea with pterygium and pseudopterygium, in keratatis disciformis, and keratitis filiaris. Cysts of the stroma are implantation cysts which follow perforations and widened lymph spaces. The cysts may be considered as the manifestation of a degenerative process. The stroma becomes necrotic and liquefied. Ingrown blood vessels carry off the liquefied mass and a cystic cavity remains. The author describes two cases of corneal cyst. (4 figures) R. Gunfeld.

D'Ermo, F. **Clincal and bacteriologic study of the possible treatment of angular conjunctivitis with a new antibiotic, 5-nitro 2-furaldehyde semicarbazone.** Boll. d'ocul. **29**:97-110, Feb., 1950.

This drug has been used with success in the treatment of diseases due to Gram positive and a negative germs. It is said to destroy tetanus spores and to be effective in cases of sulfonamide or penicillin resistance. D'Ermo used the preparation "furazina" produced by the Instituto Biochemico Torinese. Fifty-five patients were treated with furazina and the in vitro action of the drug was tested on agar-ascites or agar-blood plate cultures of the Morax-Axenfeld bacillus. A 10 percent furabina solution was more bacteriostatic than a 2-percent zinc sulphate solution. For therapeutic use, a 30-percent aqueous furazina solution was used and well tolerated. In all cases of diplobacillary conjunctivitis and blepharoconjunctivitis, good results were obtained but not in other eye diseases. (2 figures)
K. W. Ascher.

D'Ermo, F. **A particular corneal degeneration within a conical cornea.** Boll. d'ocul. **29**:217-222, April, 1950.

A 19-year-old girl with bilateral keratoconus had grayish dots among gray nodules with indistinct margins in the central and deep layers of the corneal parenchyma, mainly in the paraxial area. The extreme periphery and the epithelium were normal. (1 figure)
K. W. Ascher.

De Ferrari, G. **A rare case of congenital sclerocorneal cyst.** Boll. d'ocul. **29**:223-233, April, 1950.

Of this disease only 15 cases have been reported. A 2½-year-old boy had an ovoidal cyst, 7 or 8 mm. in diameter, in the nasal inferior quadrant of the left eye which involved cornea and sclera. The anterior wall of the cyst was excised; it was covered on both sides by stratified epithelium. In 8 months no recurrence was seen. Fetal inclusion of conjunctival epithelial tissue was assumed. (7 figures, 36 references) K. W. Ascher.

Fischer, F. P., Hodgson, L., and Wagenaar, J. W. **The treatment of corneal burns.** Ophthalmologica **119**:257-262, May, 1950.

A case of carbide burn of the cornea in a 14-year-old white boy was very strikingly improved by the unintentional local application of a congener of epinephrine of the trade name Corvasymton and of the formula dioxyphenyloxymethylaminoethanol. With this compound similar beneficial results were obtained in experimental acid and alkali burns of rabbits.
Peter C. Kronfeld.

Henry, Margaret. **Oculoglandular conjunctivitis due to leptothrix.** J. Pediat. **37**:535-544, Oct., 1950.

In seven of the eight cases of oculoglandular conjunctivitis, exposure to cats, which accounts for the frequent occurrence in children, was noted. Eosinophilia was present in two patients. The conjunctival lesions display several grayish areas of focal necrosis. There often is a preauricular and submaxillary adenopathy and a fever. Smears, cultures, and biopsies are of help in confirming the diagnosis. Treatment with sulfadiazine systemically and sodium sulfacetamide locally was followed by recovery in 7 to 14 days. Two cases in which excision was attempted, persisted almost three months. (10 figures) H. C. Weinberg.

King, J. H., Jr. **Unusual foreign body in conjunctiva; report of a case.** U.S. Armed Forces Med. J. **1**:665-667, June, 1950.

A wild barley seed pod was lodged in the superior conjunctival fornix for 13 months. Microscopic examination of the fornix tumor which had formed revealed a granulomatous giant cell reaction.

Benjamin Milder.

Lasky, M. A. **Corneal response to emetine hydrochloride.** Arch. Ophth. **44**: 47-52, July, 1950.

Attention is directed to the potential toxicity of ipecac powder and emetine hydrochloride to the eye when these substances are dusted or instilled into the conjunctival sac. A case is reported illustrating the severe pathologic change and great loss of vision the chemical can induce. In accordance with McLaughlin's recommendation, denudation is suggested as a therapeutic means to the production of a more satisfactory healing process. R. W. Danielson.

Petzetakis, M. **Ocular disturbances during malnutrition: superficial trophopenic keratitis (epithelial keratopathy).** Presse Med. **58**:1082-1084, Oct. 4, 1950.

These observations were made during the years of hunger in Greece from 1941 to 1944. The word trophopenic was coined to describe the nutritional disturbance which follows famine and is characterized by edema and by motor, sensory and trophic disturbances. In the eye the chief symptoms consist of edema of the lids and conjunctiva, corneal anesthesia, diminshed pupillary reflex, dryness of the globe and changes in the cornea. Diplopia and xerophthalmia occurred rarely, as did hemeralopia. The eyeground was normal except for anemia, and visual disturbances were absent or slight. The lesions are degenerative, not inflammatory and are due only in part to lack of vitamins; hypoglycemia, hypoproteinemia and hypolipemia are present. The eye is but one of the tissues affected by the disturbances in the peripheral and central nervous system.

A diet rich in protein, fat and vitamins A, B and C brings about a rapid cure in most patients although some die in spite of treatment and in these the eye changes persist until the end. Beer is almost a specific therapeutic agent; opacities clear, keratomalacia heals and nervous and intestinal disturbances abate soon after drinking it.

In the 331 cases observed autopsy was carried out in 11, with histologic studies of the eye. Edema of the fibers and vacuolar degeneration were characteristic of trophopenic keratitis. (6 photomicrographs). B. T. Haessler.

Randolph, M. Elliot. **Experimental study of the possibility of transmitting syphilis by a corneal graft.** Tr. Am. Ophth. Soc. **47**:683-691, 1949.

Experiments in which corneas from rabbits with latent and active syphilis were transplanted to normal rabbits

failed to show transmission of the disease.

Corneas of rabbits with active and latent syphilis were emulsified and injected into the subconjunctival tissue and into the testis of normal rabbits. During a nine-month period there was no development of either keratitis or orchitis.

David Harrington.

Simpson, G. V. **Corneal edema.** Tr. Am. Ophth. Soc. **47**:692-737, 1949.

Edema of the cornea is a symptom of serious eye disease, and is common to a large number of conditions. The subject is discussed in a general way and the various clinical manifestations and causes of corneal edema are discussed in detail. Various forms of therapy are outlined.

David Harrington.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Celeste, João. **A case of eyelash in the anterior chamber.** Arq. brasil de oftal. **13**: 18-21, 1950.

The cilium had remained in the anterior chamber 18 years. It was on the front of the iris without inflammatory reaction. The patient refused surgical removal. (1 figure, references) W. H. Crisp.

Chinaglia, V. **Persistent pupillary membrane. Clincal and histologic contribution.** Ann. di ottal, e clin. ocul. **76**: 161-184, June, 1950.

From a histologic study of the excised fragments of dense persistent pupillary membranes that interfered with vision in two patients four tentative conclusions are drawn. 1. Persistent pupillary membrane can be interpreted as the result of an intra-uterine inflammatory process that transformed the anterior part of the vascular sheath of the lens into connective tissue. This cicatricial tissue, unlike the normal sheath, resists absorption. 2. The pathologic process is not typical of a true luetic granuloma. Only in certain cases can it be affirmed that lues is an etiologic factor. 3. Concomitant changes in the crystalline lens indicate that the pathologic process begins in the third fetal month. 4. Other congenital anomalies, most frequently myopia, are almost always present and due to the same cause. The literature and the various embryogenetic theories are reviewed at length. (15 figures, 22 references)

Harry K. Messenger.

Denig, Rudolph. **Additions to my interpretation and treatment of sympathetic ophthalmia and primary glaucoma.** Klin. Monatsbl. f. Augenh. **116**:583-590, 1950.

The author asserts that, through mechanical irritation, the prolapse of an intact uvea releases a vasomotor reflex which is capable of producing increased tension in a predisposed eye. Prolapse of an injured uvea, however, causes chemotactic irritation and inflammation at the site of the injury. The decomposition products are carried by the bloodstream to distant parts of the uvea and uveitis results. By indirect reaction, vasomotor reflexes, and vasomotor psychoreflexes through anxiety, fear, and restlessness, dilatation of the vessels and stagnation of the blood occurs in the uvea of the second eye. Opportunity is now given for lodgment in the dilated capillaries of the second eye, of products of chemical decomposition from the area of the uveitis of the first eye. The decomposition products on reaching the second eye release a direct sensory vasomotor reflex and sympathetic ophthalmia results. In order to prevent sympathetic ophthalmia or glaucoma the prolapsed uvea must be isolated. This is accomplished by diathermy punctures around the wound and by novocaine block of the cervical sympathetic ganglion. The diathermy punctures de-

stroy the nerves around the capillaries which maintain the vasomotor reflex.

R. Grunfeld.

Salgado Benavides, Enrique. **A case of tuberculous uveitis treated with streptomycin.** Arch. Soc. oftal. hispano-am. **10**:351-356, April, 1950.

A woman, 35 years old, had had recurrent attacks of chronic seroplastic tuberculous uveitis in the right eye for 18 years; the pupil was completely occluded by an inflammatory membrane and vision was reduced to light perception. Similar attacks had involved the left eye for three years, with resulting posterior synechia, and vision reduced to 1/4. Since all classical methods of therapy had been used unsuccessfully, the patient was given 1 gram of dihydrostreptomycin sulphate daily in divided doses. At the end of ten days an improvement in the patient's general condition was apparent. At the end of a month the right eye could count fingers at a half-meter distance. After the administration of 100 grams of streptomycin the vision of the left eye rose to almost normal, and that of the right eye to 1/10. The clearing of the vitreous of fine pigmented opacities, with which it was densely infiltrated, is a definite indication of the effectiveness of the therapy.

Ray K. Daily.

Spadaro, Francisco, Jr. **Iritis and chronic dacryocystitis.** Arq. brasil. de oftal. **13**:64-65, 1950.

A case of iritis was relieved promptly by extirpation of a chronically diseased lacrimal sac.

W. H. Crisp.

Toselli, Carlo. **Syphilitic uveo-papillitis.** Rassegna ital. d'ottal. **19**:301-306, July-Aug., 1950.

The literature pertaining to complications at the posterior pole of the eye occurring in anterior uveitis are reviewed. The author describes an instance of bilateral, luetic papillitis which developed during the course of an anterior uveitis which was completely cured by the use of penicillin and vitamin B.

Eugene M. Blake.

9

GLAUCOMA AND OCULAR TENSION

Bietti, Giambattista. **Surgical intervention on the ciliary body. New trends for the relief of glaucoma.** J.A.M.A. **142**:889-897, March 25, 1950.

Reduction in quantity of aqueous output for the purpose of lowering ocular tension is a rather old therapeutic advance but unpopular until the advent of diathermy. Superficial diathermic coagulation of the ciliary body was quickly followed by multiple diathermic perforations of the sclera in the ciliary region. Complications such as scleral necrosis, hemorrhages, cyclitis and phthisis bulbi have occasionally occurred. Histologic examination shows enormous vasodilation of the ciliary body and adjacent parts of the iris and choroid. The application of solid carbon dioxide through unbroken conjunctiva 3 or 4 mm. from the limbus is less drastic. Freezing differs materially from diathermy in that it does not coagulate and its effect is reversible. Best results are obtained in hypertensive uveitis. More recently the method of obliterating the blood supply of the ciliary body by occlusion of the long posterior ciliary arteries through coagulation has been suggested. This harmless procedure should be done while vision is still normal and tension between 30 and 40 mm. Hg or it may be used to complement incomplete results of iridectomy or cyclodialysis. Perforating cyclodiathermy is the method that is most certain to bring about permanent results although its complications are more frequent, and occasionally so severe that enucleation becomes necessary. Nonperforating dia-

thermy is less radical but the reduction of tension that results is less durable. Electrolytic or diathermic obliteration of posterior ciliary arteries requires a more refined operative technique and results are somewhat questionable. All these methods are, in general, advised only when the common operative procedures have failed or are contraindicated, as, for example, in glaucoma in aphakic eyes; yet, because of their harmlessness and ease of repetition, most of them may well be tried before more complicated and dangerous procedures. They are advisable when transient though urgent lowering of tension is necessary, as in hypertensive uveitis, or when tension is increased after keratoplasty.

C. L. LaRue.

Blake, E. M. **How should we study primary glaucoma?** Tr. Am. Ophth. Soc. **47**:324-335, 1949.

The various factors of importance in the pathogenesis of glaucoma are reviewed including the anatomic, hereditary, psychogenic, vascular, nervous and metabolic. A plea is made to establish a foundation for the study of glaucoma from the point of view of study of the individual with glaucoma as well as the eye of the glaucoma patient.

David Harrington.

Gába, Vladimir. **The resistance of the trabeculum to filtration in chronic simple glaucoma.** Ophthalmologica **119**:262-267, May, 1950.

This paper is essentially a critical analysis of Goldmann's paper on the outflow of pressure and Ascher's glass rod phenomenon (Ophthalmologica 116:195, 1948, cf. this journal 32:750, 1949). Gába's main point is that Goldmann's concept of an abnormally high resistance, in chronic simple glaucomas, to filtration between anterior chamber and canal of Schlemm does not have a sound basis since the pressure in the episcleral veins was not measured both at the time of the determination of the outflow pressure and at the time of the observation of the negative glass rod phenomenon. Without such measurements it is unjustifiable to assume that most of the pressure gradient between anterior chamber and episcleral veins is within the corneoscleral trabeculum. Peter C. Kronfeld.

Gonçalves, Danilo. **Hydrophthalmia associated with facial nevus.** Rev. brasil. de oftal. **9**:21-25, Sept., 1950.

A girl of 3½ years had enlargement of the right half of the face. The skin in this area bled when touched, the skin from the tragus to the right external commissure covered the vascular cords. Death occurred a day after a pleurisy a month later. It was impossible to obtain an autopsy. W. H. Crisp.

Gonzalez-Pola, Angel Moreu. **On the cause of true glaucoma.** Arch. Soc. oftal. hispano-am. **10**:592-599, June, 1950.

The author emphasizes the importance of differentiating between hypertension, which is secondary to other processes, and true glaucoma, which is caused only by an ocular neurovegetative instability, with an adverse effect on the ocular circulation. He reviews briefly the argument for his conception of the disease, described in detail in his book, and emphasizes the importance of investigating the drainage facilties of a glaucomatous eye before operating, lest the hyperemia incident to the operative trauma, combined with the completely obstructed drainage, result in malignant glaucoma. The effect of surgery on a glaucomatous eye manifests itself in two phases. The first and immediate is a ciliary vasodilatation with an active hyperemia which modifies the circulatory stasis associated with glaucoma; the second and delayed is an atrophy of the ciliary body with func-

tional loss of the affected area and a hypoproduction of aqueous.

Ray K. Daily.

Hasselmann, Günther. **Liver-function tests in primary glaucoma.** Klin. Momatsbl. f. Augenh. **116**:596-600, 1950.

The author applied four of the newer liver-function tests to 40 patients with glaucoma. Of the glaucoma patients 90 percent were proved to be free of liver disease whereas control examinations on 100 patients free of glaucoma showed that only 80 percent had normal livers. Any connection existing between glaucoma and liver disease must therefore be denied. R. Grunfeld.

Hauck, D. L., and Biggins, C. H. **Use of DFP in the treatment of refractory glaucoma.** Med. Arts and Sc. **3**:53-55, 3rd Quart. 1949.

DFP completely destroys cholinesterase, and produces a much longer response than any agent previously used. 70 percent of 17 refractory cases responded to DFP therapy. Of these 35 percent were adequately controlled. Two cases did not respond to DFP therapy, but became responsive to pilocarpine. Thirty percent of the cases had a rise in tension. Treatment had to be discontinued but no permanent harm was produced.

Irwin E. Gaynon.

Hruby, K. **Iridencleisis with the knife.** Klin. Monatsbl. f. Augenh. **116**:627-634, 1950.

A very narrow chamber is more easily opened for iridencleisis with a von Graefe knife than with the keratome and with less danger of injury to the lens capsule. A conjunctival flap is dissected from above and a scleral incision is made with the von Graefe knife 1.5 mm. behind the limbus. If the incision is too small, one may enlarge it with scissors. The iris usually prolapses, which makes the operation easier to perform. The corneal astigmatism is somewhat, but not appreciably, greater with the knife incision.

R. Grunfeld.

Klar, R. **Glaucoma and liver disease.** Klin. Monatsbl. f. Augenh. **116**:600-614, 1950.

The author examined a large number of patients with clinically manifest liver disease, such as cirrhosis of the liver and parenchymatous icterus, for detection of early glaucoma or disposition to glaucoma. A careful campimetry was plotted on all patients, a daily pressure curve was drawn, and the patients were subjected to a number of tolerance tests, such as water, caffein, darkroom tests and to homatropine instillation. In none of the patients could glaucoma or disposition to glaucoma be detected. R. Grunfeld.

Lehrfeld, L., and Belmont, O. **Glaucoma at the Wills Hospital.** Arch. Ophth. **43**:720-728, April, 1950.

In a study of 638 cases of primary glaucoma of which 75 percent were chronic simple glaucoma, 14 percent chronic congestive and 5 percent acute congestive, it was found that basal iridectomy is the operation of choice for the congestive type and the Elliot trephination for chronic simple glaucoma. In a small group of patients who had chronic simple glaucoma in both eyes and in whom one eye was treated surgically and the other medically, the medically treated eyes fared better. John C. Long.

Ligorio, A., and Toselli, C. **Familial glaucoma in emotional subjects.** Rassegna ital. d'ottal. **19**:293-300, July-Aug., 1950.

The clinical signs in the members of the family reported upon demonstrate the inter-relation of glaucoma and emotional factors. The family consisted of

two parents, six children and two cousins. Consanguinity of the parents was thought to be an important factor in the nervous and glaucomatous manifestations. Of the 10 members, 9 developed acute congestive glaucoma. Anticipation was not observed. The attacks of glaucoma were intense, all eyes were operated upon and four became blind. The neurologic and psychologic changes in each case are reported.

Eugene M. Blake.

Marlow, S. B. **Tonometry: the variation of ocular rigidity in chronic glaucoma and an adaptation of the Souter tonometer.** Tr. Am. Ophth. Soc, **47**:349-364, 1949.

The author demonstrates variation in ocular rigidity in glaucoma patients and urges that frequent determinations be made. He confirms the necessity of tonometry with two weights and urges that the scale reading and the weight used be recorded. He suggests a different method of estimating intraocular pressure by an adaptation of the Souter tonometer.

David Harrington.

Ripley, H. S., and Wolff, H. G. **Life situations, emotions and glaucoma.** Psychosomatic Med. **12**:215-224, July-Aug., 1950.

In a group of 18 glaucoma patients the appearance and exacerbation of ocular symptoms and signs coincided with a stressful situation such as anger, anxiety and depression and rarely with happiness. A variety of life's problems and their symbolic representations were associated with changes in eye findings. Failure of adaptation was evidenced by over-conscientousness, fluctuations of mood, preoccupation, inability to maintain interpersonal relationships and sexual maladjustment. Many other maladjustments as well as disturbed functions of the eye were noted. Irwin E. Gaynon.

Rohrschneider, W. **Technique and indication of cyclodiathermy puncture.** Klin. Monatsbl. f. Augenh. **116**:634-641, 1950.

The author measured the ocular tension before cyclodiathermy puncture had been made in cases of chronic simple glaucoma and a number of times after in 26 patients. The tension invariably rose to a considerable height, sometimes to over 80 or 100 mm. Hg, then fell gradually and reached its normal value in 24 hours. Vogt's dictum, to puncture until hypotony is achieved, cannot be followed for technical reasons. One or two deep punctures with longer needles perforating the sclera and ciliary body may avoid the postoperative hypertension but will not bring hypotony. The hypertension is caused by scarring and shrinking of the sclera from the effect of the diathermy. The ocular tension is raised in enucleated animal or human eyes after diathermy punctures. One should do a paracentesis after cyclodiathermy punctures. R. Grunfeld.

Sanna, M. **Angioscotometry and neuroscotometry in chronic simple glaucoma.** Boll. d'ocul. **29**:111-122, Feb., 1950.

Study of the visual fields of six patients led Sanna to conclude that the circular perimacular scotoma observed in many glaucomatous eyes is associated with glaucomatous cupping and the development of the halo around the disc. He considers the angioscotoma as an indication of functional lability of the third visual neuron, due to nutritional disturbances of vascular origin. K. W. Ascher.

Scheie, H. G. **Goniotomy in the treatment of congenital glaucoma.** Tr. Am. Ophth. Soc. **47**:115-137, 1949.

In reporting the results of goniotomy used in the treatment of 16 eyes with congenital glaucoma, the author supports the claims made for the procedure by

Barkan. Failure occurred only in eyes in which the disease was advanced. The tension was controlled in 11 of 14 eyes with congenital glaucoma. There were two failures in a patient in whom the elevated tension was associated with a port-wine nevus. Goniotomy seems to be a simple and safe procedure.

David O. Harrington.

Schmidt, Karl. **The tolerance of the glaucomatous eye in diagnosis and therapy.** Klin. Monatsbl. f. Augenh. **116**: 614-627, 1950.

The author reviews the various tolerance tests used in the diagnosis of glaucoma. The water test is the most sensitive of the tests and gives the highest percentage of positive results. A negative water test does not exclude glaucoma and a caffeine test may give a positive result. If the caffeine test fails, homatropine may be instilled for early detection of glaucoma. The different behavior of glaucoma patients to the various tolerance tests may serve to differentiate several groups and thus clarify our understanding of glaucoma. (18 figures)

R. Grunfeld.

Schulte, D. **Electrolytic destruction of the ciliary arteries as a glaucoma operation.** Klin. Monatsbl. f. Augenh. **116**:498-510, 1950.

The author destroyed one or both long ciliary arteries in 8 patients with absolute glaucoma, but he was only partially successful in lowering the tension in 3 patients and he failed to do so in the other 5 patients. The destruction of one long ciliary artery is not sufficient to lower the tension, because the flow of blood volume has already been diminished in glaucoma through compression of the capillaries by the high ocular tension. In order to decrease the ocular tension one must destroy more vessels. This is best accomplished by destruction of an annular vascular system in the region of the ciliary body and root of the iris. After opening of the anterior chamber the author introduces a spatula laden with galvanic current parallel to the limbus and coagulates the vessels of the ciliary body and the circulus arteriosus iridis major. The tension was permanently reduced in 3 patients with absolute glaucoma, partially in one and not at all in 3.

R. Grunfeld.

Torres-Lucena, M. **The behavior of the ocular tension, in a group of normal subjects, under strong emotional stress.** Arch. Soc. oftal. hispano-am. **10**:743-754, July, 1950.

The source of the emotional stress in these patients was a surgical procedure, such as cataract extraction or excision of chalazion. The neurovegetative tone of the patients and variations in ocular tension were determined several days before the operation. The ocular tension was then measured in both eyes on the day of the operation and after the operation in the unoperated eye. 221 patients are analyzed to evaluate the emotional stress on the two components of the autonomic nervous system, and the effect of the change in the autonomic system on the ocular tension. There was a rise in the tension as high as 11 mm. in 14.2 percent and a fall as low as 9 mm. in 6.7 percent. The most marked changes in the ocular tension appear to be associated with an increased autonomic activity; there was no change in the ocular tension in patients in which the autonomic activity was lowered. The greatest change in the activity of the autonomic nervous system was found in patients between 10 and 40 years of age. The majority of patients with a lowered ocular tension were between 70 and 80 years old.

Ray K. Daily.

10

CRYSTALLINE LENS

Atkinson, W. S. **Iris pigment flakes on posterior surface of cornea following cataract extraction.** Tr. Am. Ophth. Soc. **47**:177-182, 1949.

Large flakes of pigment dislodged during intracapsular cataract extraction may seriously affect the vision. Irrigation will usually remove that pigment which appears in the anterior chamber during and after lens delivery. If not removed the position of the pigment flake may change as the chamber forms. Proliferation of pigment greatly reduces vision and may be sufficient to make postoperative removal advisable. David Harrington.

Costi, C. **A simple and safe maneuver to aid in the intracapsular extraction of some cataracts.** Arch. Soc. oftal. hispano-am. **10**:792-795, Aug., 1950.

The maneuver described is for extracting the lens with the capsule in cases in which the capsule ruptures after the inferior border of the lens is dislocated. In such cases, as the tumbling lens is slowly expressed extracapsularly by pressure with a hook, there comes a moment when the lens is partially out of the wound, its superior border still adherent to the capsule. At this point the capsule may again be grasped with a forceps and delivery of the lens with the capsule completed. (4 figures) Ray K. Daily.

Kirby, D. B. **Use of curare in cataract surgery.** Arch. Ophth. **43**:678-693, April, 1950.

Curare acts first by depressing the action of the ocular muscles, producing in progression an effect similar to that of myasthenia gravis. This action is of value in cataract surgery as it not only causes local ocular akinesia but also results in general bodily relaxation. The drug may be used with sedatives and local anesthetics for cataract surgery or it may be combined with thiopental (pentothal) sodium for extraction under general anesthesia. When so combined, less thiopental is required. The technique of administration of curare is described and the hazards and complications attending its use are discussed. John C. Long.

Knighton, W. S. **The role of the vitreous in post-operative complications of intracapsular extraction.** Tr. Am. Ophth. Soc. **47**:606-620, 1949.

An analysis of 1,001 intracapsular cataract extractions shows that when vitreous was lost, as it was in 91 eyes, the postoperative complications were four times more frequent than in a control series with intact vitreous. The most frequent complications were iridocyclitis, keratitis, secondary glaucoma, vitreous opacities and retinal detachment. The convalesence was prolonged. Complications appeared as late as a year after operation and average vision was 20/100. David Harrington.

Poyales, A. **Comments on cataract extraction.** Arch. Soc. oftal. hispano-am. **10**:796-801, Aug., 1950.

The routine technique comprises a Graefe knife keratotomy, corneal sutures, two peripheral iridotomies, sphincterotomies in uveitic cataract and loss of vitreous, and extraction with forceps or eresiphake. In cases with shallow anterior chambers the keratotomy is made with keratome and scissors, and covered with a conjunctival flap. Only a motor eresiphake can be depended upon to provide adequate suction. Ray K. Daily.

Sanders, R. D., and Cutler, N. L. **General anesthesia in cataract surgery.** Arch. Ophth. **43**:653-660, April, 1950.

Cataract extraction in 62 patients in

general anesthesia, induced by a combination of thiopental (pentothal) sodium, nitrous oxide, oxygen and cyclopropane, are reported. In no case did the administration of the anesthesia interfere with the conduct of the operation. The technique of administration and the results obtained are presented, with a discussion of the apparent advantages and disadvantages. John C. Long.

11

RETINA AND VITREOUS

Alvarez Alvarez, Abundio. **Streptomycin in retinal tuberculosis.** Arch. Soc. oftal. hispano-am. **10**:332-341, April, 1950.

The literature is reviewed and a case of primary central exudative retinal tuberculosis in a man, 18 years old, treated with streptomycin, is reported. After 15 days of streptomycin in doses of one gram daily there was a slight improvement in the visual field of the right eye, the macular exudates and edema disappeared, and central visual acuity improved to 2/20. The conclusions reached from the experience and a study of the literature are that streptomycin is effective when immunity is good and good local and general defense reactions against tubercle bacillus are present. The dose of 3 grams daily originally used is excessive. The effectiveness of the antibiotic is dependent more on the state of the patient's immunity than on the quantity of the drug; a prolonged treatment with smaller doses is equally effective and safer. (2 figures)

Ray K. Daily.

Arruga, H. **Retrolental fibroplasia.** Arch. Soc. oftal. hispano-am. **10**:468-477, May, 1950.

The literature is reviewed and a case reported, in which retrolental fibroplasia was diagnosed when the infant was six months old. At 18 months of age the right eye had a fibrous band across the center of the retrolental space, with a fundus reflex above and below it. The left eyeball was atrophic.

Ray K. Daily.

Baurmann, M. **The venous pulse in the development and cure of occlusion of the central retinal vein.** Klin. Monatsbl. f. Augenh. **116**:461-471, 1950.

The venous pulse appears when the ocular tension surpasses the venous pressure existing in the orbit. If one measures the venous pressure in cases of occlusion of the central retinal vein and if one notices that the pressure gradually falls and eventually returns to its normal value, or if the venous pulse reappears on ophthalmoscopic examination, the prognosis is good. If, however, the pressure remains high the prognosis is bad. Similarly, one can predict a venous occlusion when the intraocular venous pressure remains persistently high for a considerable time. R. Grunfeld.

Bedell, A. T. **Retinitis punctata albescens.** Tr. Am. Ophth. Soc. **47**:262-275, 1949.

Two cases of this condition are reported with photographic records extending over 13 years. One patient developed night blindness and pigmentary changes of retinitis pigmentosa, the other did not. The condition may be confused with drusen, Gunn's dots, vitreous reflexes, resolving macular star, a rare phase of diabetic retinopathy, subsiding thrombosis of a retinal vein, small exudates and small cholesterin deposits.

David Harrington.

Belmonte Gonzalez, Nicolas. **Erythremia in hypertensive retinopathy.** Arch. Soc. oftal. hispano.am. **10**:453-457, May, 1950.

In former publications the author advanced the concept that the immediate

cause of retinal changes in general hypertension is anoxia of the retina. In support of this contention he cites the fact that a fundus picture identical to that of advanced hypertension is encountered in anemic retinopathy. The reaction of an organism to acute anoxia is an accelerated respiratory rate and cardiac rate with increased circulation of blood. The reaction to chronic anoxia is an increased number of red cells. In this investigation the author sought to establish the reaction of the organism to hypertension anoxia. Hypertensive patients were examined for red cell count, hemoglobin content and the diastolic brachial and diastolic retinal pressures. The patients were classified in four groups, similar to those of Wagener and Keith. The average figures computed from these data show insignificant changes in the blood picture, as well as the diastolic pressures, in the first stage of general hypertension, in which the retinal hypertension has no objective clinical manifestations, and can be demonstrated only by ophthalmodynamometry. In second-stage hypertensives, with changes in the vessels visible in the fundus, the blood picture shows an increased number of red cells. In third-stage hypertensives, with retinal complications, such as hemorrhage or thrombosis, the number of red cells is below that of the second stage and but slightly above normal. In the fourth stage with advanced and grave changes the blood picture is that of hyperchromic anemia. It is apparent that in the course of hypertension there is first an increase in the red cell count, followed by a fall to the point of anemia. In the transition from an erythremia to anemia the number of red cells passes through the normal stage, which accounts for the fact that so many hypertensives present a normal red cell count. The erythremia at the onset and in the early stage of hypertension is regarded as an effort on the part of the organism to compensate for the tissue anoxia, produced by the diminished blood supply resulting from the narrowing of the vessels.

Ray K. Daily.

Borley, W. E. **The scleral resection (eye-ball shortening) operation.** Tr. Am. Ophth. Soc. **47**:462-497, 1949.

The scleral resection operation for retinal detachment is reviewed from its inception in 1903. Results of experimental studies and the experience gained in 28 operations are recorded. The operative technique and post-operative complications are described in detail. The indications for the operation and end results are given. David Harrington.

Friedenwald, J., and Day, R. **Vascular lesions of diabetic retinopathy.** Johns Hopkins Hosp. Bull. **86**:253-254, April, 1950.

The alarming increase in the incidence of so-called degenerative complications of diabetes comes with the prolongation of life in the present day diabetic. Retinopathy is related to the duration of the diabetes rather than to age of the individual or the treatment employed. The authors' histologic studies reveal mainly the great frequency of saccular capillary aneurysms. This is the most characteristic retinal vascular lesion. Hemorrhages and exudates frequently surround the aneurysm indicating that weaknesses in the vessel wall are associated with the aneurysms. Francis M. Crage.

Gonzalez Pola, Angel M. **The problem of pathogenesis and treatment of hemeralopic retinopathy.** Arch. Soc. oftal. hispano-am. **10**:458-467, May, 1950.

Retinitis pigmentosa, for which the author prefers the designation hemeralopic retinopathy, appears in two forms, a

hereditary form, in which the neuroepithelial degeneration involving the tissues of ectodermal origin is the primary process, and the choroid is normal, and an acquired form secondary to vascular disturbances in the choroid. Nettleship found a history of heredity, consanguinity or lues in only 60 percent of cases. During the civil war the author had the opportunity to examine many patients with nocturnal hemeralopia, and he has histories of over 100 cases of hemeralopic retinopathy. The study of these patients convinced him that there is a form of the disease which can be acquired at any period of life. A patient whom he had observed for 15 years had a pituitary adenoma, and when first seen his fundi were normal. He was treated by deep radiotherapy to the pituitary and after the first few treatments developed a pigmentary macular degeneration with a reduction in visual acuity and night blindness. Gradually peripheral pigmentation and the annular scotoma characteristic of retinitis pigmentosa appeared. The author believes that the abiotic processes of retinitis pigmentosa are in reality results of disturbances in the eutrophic center of the hypophysis. Hereditary cases with definite involvement of the choroid also occur. The examination of children of patients with retinitis pigmentosa revealed atrophic areas in the choroid and hemeralopia before the appearance of pigmentary changes. Only 6 percent of these children had hemeralopia without choroidal lesions. The author urges that a patient with retinitis pigmentosa be investigated from the standpoint of heredity, consanguinity, the state of the choroid, the endocrine neurovegetative system and the mesodermic tissues. The two types of the disease vary in their response to therapy. While primary involvement of the neuroepithelium has a very poor prognosis, primary involvement of the choriocapillaris may be held stationary by therapy for many years. For this purpose the author uses pituitary extract, liver extract, vitamin B and vasodilators. Results with tissue therapy have been discouraging.

Ray K. Daily.

Inigo, L. **Groenblad-Strandberg syndrome.** Arch. Soc. oftal. hispano-am. **10**: 755-758, July, 1950.

The literature on the pathogenesis of angioid streaks is briefly reviewed and a case is reported. The patient had cutaneous lesions indicative of a congenitally inferior resistance of the elastic tissues.

Ray K. Daily.

Jäger, A. **Physical bases for the retinal-vessel diagnosis in internal medicine and neurology.** Klin. Monatsbl. f. Augenh. **116**:449-461, 1950.

The venous pulsation seen on the disc is not a true pulsation. It is merely compression of the vein by the ocular tension. In systole the arteries increase their volume and the ocular tension rises by 1½ to 3 mm. Hg. This rise is suffiicent to compress the vein. The venous pressure during diastole must exceed the intraocular pressure otherwise there would be no venous flow. The capillary pressure must raise the venous pressure until its exit pressure reaches the pressure existing in the cavernous sinus or the intracranial pressure. The venous pulsation is seen when the intraocular pressure is higher than the venous pressure behind the globe, the intracranial pressure.

True reflex is only the narrow reflex seen on the vein. The retinal artery shows a broader reddish reflex streak, light reflected from the retina. The blood current forces the blood corpuscles to lie parallel to the wall. The middle portion of the artery lets the light go through easily and therefore it appears

bright. The light, however, is reflected by the edges of the blood corpuscles and the sides of the artery therefore appear dark. The thickening of the vessel walls increases the hard surface reflex.

R. Grunfeld.

King, M. J. **Retrolental fibroplasia.** Arch. Ophth. **43**:694-711, April, 1950.

The author presents data based on the observation of 238 patients with retrolental fibroplasia. This series includes the original 117 patients of the late Theodore L. Terry. The cause of the disorder remains unknown. Prematurity and subnormal weight at birth are predisposing factors in a large majority of cases. Multiple births occured 54 times in the series. This is apparently significant only with regard to the relation of multiple births to prematurity. The common complications of retrolental fibroplasia were synechias, secondary glaucoma, retinal detachment and cataract. Psychiatric studies do not indicate that there is a higher incidence of real mental retardation than is found in the average group of prematurely born children. In this series seventy-one were totally blind; 21 of 210 children, whose vision could be determined, had vision of 20/200 or better in at least one eye. Treatment of retrolental fibroplasia is purely symptomatic. There is at present no cure for the disease.

John C. Long.

Laval, Joseph. **Glioma of the retina in father and child.** Arch. Ophth. **44**:140-145, July, 1950.

Bilateral retinoblastoma occurred in a child whose father had had an eye removed for the same condition, and gives further support to Reese's statement that "of 184 cases of retinoblastoma there were only 5 survivors with children. The children total 8, and 7 of these had bilateral retinoblastoma. There figures are sufficiently impressive to me to interdict the bearing of progeny by all survivors of retinoblastoma." Laval further states that radiation therapy of a glioma of the retina should not be attempted if more than one sixth, or at the most one fourth, of the retina is involved. If only one eye is affected and the other eye is normal, radiation therapy should not be given, regardless of how small an area is involved; the eye should be enucleated. All survivors of glioma should be warned not to have children. R. W. Danielson.

Lefkovits, A. M., and Young, J. M. **Lipemia retinalis and xanchoma diabeticorum in diabetes mellitus.** Ann. Int. Med. **32**:755-759, April, 1950.

This is the sixty-second such case reported in the literature. The patient was a white man, 21 years of age. The xanthoma was almost universal but it was worse on the extremities. A diet high in carbohydrates and proteins and low in fats plus sufficient insulin was followed by prompt, almost complete clearing of the xanthoma and total clearing of the retina. Francis M. Crage.

Merriam, G. R. **Retinoblastoma: analysis of seventeen autopsies.** Arch. Ophth. **44**:71-108, July, 1950.

Autopsies in 17 cases of retinoblastoma are analyzed. The sites of metastatic spread and their relative frequency are tabulated, and the method of dissemination to these areas is discussed. It was found that although 16 of the cases had some form of intracranial metastasis, only 8 died with the disease confined to the head or spinal cord or both. In the other 9 cases there were distant metastases in addition to those present within the skull. The lymph nodes were involved in 8, the skull bones in 9, distant bones in 9 and the viscera in 8 cases. The cases are classified according to the areas involved, and this classification is compared with a similar one prepared from cases reported

in the literature. The most important aspect of this analysis is the finding that retinoblastoma is by no means the purely local and cranial disease it is so often considered. It is, rather, a highly malignant, widely disseminated neoplasm.

R. W. Danielson.

Morón-Salas, J. **Obliteration of retinal tears by coagulation with light.** Arch. Soc. oftal. hispano-am. **10**:566-578, June, 1950.

The author describes in detail his experimental work on guinea pigs in which he attempted to coagulate retinal tears by concentrating sunlight upon them. To eliminate the disadvantage of variability of the intensity of sunlight, the author investigated the use of arc light with various filters. The latter causes intense photophobia and makes the animal restless. An attempt to treat retinal detachment in man failed in four cases. (10 figures) Ray K. Daily.

Pallarés, J. **Synthetic antihistaminics in central serous retinopathy.** Arch. Soc. oftal. hispano-am. **10**:555-565, June, 1950.

The literature is reviewed and the case of a man, 39 years old, who developed a central serous retinopathy of the right eye is reported. He complained of a small round spot in the center of his visual field and his vision was reduced to 0.1. The patient made a prompt recovery after the extraction of two infected teeth, and the administration of calcium gluconate intravenously and antistine by mouth. The author regards this clinical manifestation as an allergic episode in the macula; the transitory macular tumefaction, shifting in position at times, the tendency to recurrence, and the complete reversibility of the process justify the diagnosis of an allergic manifestation. The local allergic reaction, associated with the liberation of histamin, occurs when small doses of bacterial protein from some infected focus come in contact with the macula, which has been sensitized through previous contacts with the toxin. The antihistaminics counteract or diminish the effect of histamin, and calcium reinforces their action. In the absence of a demonstrable focus of infection, allergy to tuberculosis should be considered. Ray K. Daily.

Puig Solanes, M. **Comparative study of the ophthalmoscopic changes in essential arterial hypertension and in hypertension from chronic glomerulonephritis.** An. Soc. mex. de oftal. **23**:152-171, July-Sept., 1949.

A study of 260 cases of essential hypertension and 50 cases of chronic glomerulonephritis showed that the retinopathies associated with these diseases are qualitatively similar but differ quantitatively. The lesions of the retinal tissue are more intense in glomerulonephritis. (8 graphs)

W. H. Crisp.

Sautter, Hans. **Clinical disturbances of arterial bloodflow in the retina.** Klin. Monatsbl. f. Augenh. **116**:471-482, 1950.

Vascular disturbances in the retina have greatly increased in recent years. This may be ascribed partly to improved clinical diagnosis and observation. Arteriosclerosis and high bloodpressure lead to well recognized changes in the fundus and lowered blood pressure leads to functional vascular disturbances and, eventually, to permanent anatomic changes. Such vascular damages are thromboangiitis obliterans, Raynaud's gangrene and closure of the central retinal artery and vein. To treat these conditions successfully one must consider them as reversible phenomena. Treatment must be instituted not only when the vascular obstruction is recent, but after several weeks. The treatment in hypertension consists of lowering the blood pressure and dilating the blood

vessels with suitable drugs, such as acetylcholin, prostigmin and eupaverin; then after a few hours raising the blood pressure with the injection of caffeine, suprifen, effortil, or pervitin. This vessel exercise must be repeated two or three times a day for several days. If the vascular obstruction was due to subnormal blood pressure then the blood pressure must first be raised and later lowered. In some cases improvement is noted after the first injection. In obstinate cases one must resort to retrobulbar injections. Paracentesis or iridectomy are valueless. The author describes five illustrative cases. R. Grunfeld.

De Torres-Lucena, M. **The present status of treatment of retinal glioma.** Arch. Soc. oftal. hispano-am. **10**:600-603, June, 1950.

Torres-Lucena comments on the usual hopelessness of this disease and refers to Stallard's remarkable results with radon implanted on the eyeball. Since this therapy is successful only in early cases, it is the task of the ophthalmologist to discover these neoplasms early. In the group of patients included under the Health Insurance Service patients are seen much more frequently than formerly, and come for consultation for very trivial affections. He urges ophthalmologists to perform careful fundus studies on infants routinely in order to diagnose these tumors in a stage in which there is hope in therapy. Ray K. Daily.

Torres-Lucena, M. **Macular and paramacular lesions in the young.** Arch. Soc. oftal. hispano-am. **10**:882-889, Aug., 1950.

The author describes five cases with changes in the pigment epithelium in the macular and paramacular regions, and one in which the changes were limited to the macula. The patients were young people without a family history of hereditary lesions and without general disturbances ascribed to the ocular changes. The ophthalmoscopic picture consisted of a variable number of red foci, of various sizes, with sharp pigmented borders in the macular and paramacular areas. There was in addition a fine pigment dust scattered over the posterior pole, and white or red foci similar to drusen. The bilateral, irreversible ocular lesions produced no functional disturbances. The etiology of these lesions is unknown. (6 figures) Ray K. Daily.

Unsworth, A. C. **Retrolental fibroplasia or ophthalmic dysplasia of premature infants.** Tr. Am. Ophth. Soc. **47**:738-771, 1949.

Ten cases of retrolental fibroplasia or ophthalmic dysplasia were observed from birth through the onset and development of the disease. It is not due to the persistence of or redevelopment of the embryonic hyaloid vascular system. There is a direct relationship to the amount of prematurity, which is a predisposing factor. The other factors are obscure.

The process appears to be inflammatory, involving the anterior uvea, vitreous and retina, causing angiomatosis, retinal hemorrhage and angioplasia in the vitreous. The two main types of the disease are central and peripheral.

David Harrington.

Valientie de Oliveira, Luis. **Ocular fundus in arterial hypertension.** Arq. brasil. de oftal. **13**:33-63, 1950.

The arteriosclerotic changes found in the fundus are described.

W. H. Crisp.

12

OPTIC NERVE AND CHIASM

Mata Lopez, Pedro. **Retrobulbar optic neuropathy.** Arch. Soc. oftal. hispano-am. **10**:653-742, July, 1950.

In this exhaustive monograph on retro-

bulbar neuritis, the author includes all lesions of the optic nerve, whether inflammatory, degenerative or vascular, regardless of etiology, with or without ophthalmoscopic signs, and with characteristic changes in the visual field. The author prefers the classification of Wilbrand and Sänger, made on an anatomicopathologic basis. The etiology is attributed in descending frequency to multiple sclerosis, acute infections, alcohol, tobacco, and a combination of the two toxins alone, or associated with avitaminosis. The latter was found particularly frequently during epidemics of hunger and war. Only a minor role is attributed to the paranasal sinuses. It is emphasized that the differential diagnosis between retrobulbar neuritis and intracranial tumor is a grave responsibility, the operability of some tumors depending on an early diagnosis. The symptoms of the various types of the disease, the visual fields, and therapy are discussed in detail, and a diagnostic chart for differential diagnosis is presented. (Visual fields, 128 references) Ray K. Daily.

13

NEURO-OPHTHALMOLOGY

Bardram, M. T. **Oculomotor pareses and nonparetic diplopia in pituitary adenoma.** Acta ophth. **27**:224-258, 1949.

A review of the data on pituitary adenoma at the neuro-surgical department of the Rigs Hospitalet demonstrates the importance of oculomotor pareses in their symptomatology. A manifest paresis was observed in eight of 90 verified cases of adenoma. In three of these there were no visual field changes; in 7 the oculomotor nerve was involved; one patient had miosis and ptosis and one had pain in the region of the trigeminus. The pathogenesis of the paresis is discussed, and it is pointed out that the nerves may be affected either in the cavernous sinus or outside of it. In 15 of the 90 cases the patients complained of diplopia, without demonstrable paresis of any ocular muscle. Bitemporal hemianopsia was present in all, and visual acuity was significantly reduced. The diplopia without demonstrable muscle paresis is attributed to a secondary divergence resulting from defective fixation because of reduced central vision combined with hemianopsia. (Visual fields) Ray K. Daily.

Borsello, G. **The syndrome of Foster-Kennedy in a patient with cerebral lues.** Atti d. 37 Congresso Soc. oftal. ital. **10**: 554, 1948.

This case shows that a gummous meningitis can produce a Foster-Kennedy syndrome which is therefore not absolutely pathognomonic for a tumor.

Frederick C. Blodi.

Calhoun, F. P., Jr. **The clinical recognition and treatment of epithelialization of the anterior chamber following cataract extraction.** Tr. Am. Ophth. Soc. **47**: 498-553, 1949.

The literature is reviewed and 20 cases studied by the author are analyzed with regard to clinical signs and symptoms, etiology, and treatment. Epithelialization may be difficult to diagnose, its incidence is probably greater than is realized, and it almost invariably leads to loss of useful vision or loss of the eye. X-ray therapy offers the only hope of arresting the condition and is useless unless given early. Operations to relieve the glaucoma or give a pupillary opening are unsuccessful and usually make the condition worse.

David Harrington.

Donahue, H. C. **Migraine and its ocular manifestations.** Tr. Am. Ophth. Soc. **47**: 554-605, 1949.

Migraine is a symptom complex that results from a vasoconstriction and probably secondary vasodilation due to cer-

ebrovascular imbalance. In most cases the headache is due to distention of the intracranial branches of the external carotid artery while the visual auras are due to anoxia resulting from angiospasm. The causes and types of basic disturbance vary and may include toxic, hepatic and duodenal disorders or endocrine irregularities. Heredity plays an important part and there seems to be a definite migraine personality which exhibits considerable tension and tendencies to vasomotor imbalance. Ocular symptoms are very common.

In the examination of 1,600 case reports of migraine, visual aura were found to occur in 34 percent in the form of scintillating scotoma and fortification spectra. Hemianopsias occurred in 4 percent. Various ocular palsies, which occurred in 17 percent, were transient; 88 percent of these involved the third nerve. Spasm of retinal arterioles have been observed. The average age of onset was 22 years. No gross or histologic pathologic tissue change has been demonstrated.

David Harrington.

Frantz, K. E. **Amnesia for left limbs and loss of interest and attention in left fields of vision.** J. Nerv. and Ment. Dis. **112**:240-244, Sept., 1950.

The author describes a 55-year-old man who developed headache, loss of interest and attention in the left homonymous fields and in the left half of his body. This progressed to left homonymous hemianopia, stupor and death. Necropsy showed a bronchiogenic carcinoma with metastasis to the brain. There were two separate lesions, one in each occipital lobe; the one on the right side was much larger and was the cause of the syndrome presented. The small one on the left side was the cause of the disorientation of the last few weeks of life. The center of the neoplasm was on the border between the parietal and occiptal lobes. Its extension backward seems to have caused Riddoch's syndrome, while its extension forward caused amnesia for the opposite limbs.

Theodore M. Shapira.

Goar, E. L. **The eye in diseases of the nervous system.** New Orleans M. and S. J. **102**:609-613, June, 1950.

The various neurologic conditions which are often first discovered by the ophthalmologist are described. They are: multiple sclerosis, brain tumor, myasthenia gravis, and the phakomatoses and ocular palsies indicating central nervous system disease or injury. The writer also points out the difference between thyrotoxic and thyrotropic exophthalmos.

Donald T. Hughson.

Haddock, J. N., and Berlin, L. **Transsynaptic degeneration in the visual system; report of a case.** Arch. Neurol. and Psychiat. **62**:66-73, July, 1950.

Primary optic nerve atrophy appeared bilaterally three years after a gunshot wound in both occipital lobes. This progressed to severe atrophy five and one-half years after the injury.

The literature is reviewed and although this case is presented to help support the theory of transsynaptic degeneration of fibers it is apparent that this degeneration in the visual fibers following injury to the occipital lobes has not been well established. (2 figures)

H. C. Weinberg.

Holmes, Gordon. **Pure word blindness.** Folia psychiat., neurol. et neurochir. neerl. **53**:279-288, April, 1950.

A case of pure word blindness in a 72-year-old physician is presented. He had a right upper quadrant homonymous hemianopia. His vision was good, although it was impossible to test him with Snellen type. It is probable that the lesion was in the neighborhood of the left angular gyrus.

Irwin E. Gaynon.

Leoz de la Fuente, Gustavo. **Ocular paralysis as a symptom of nonsuppurative encephalitis. (Landry-Guillain-Barret syndrome.)** Arch. Soc. oftal. hispanoam. **10**:825-850, Aug., 1950.

The variability of the symptoms in epidemic encephalitis in which ocular muscle paralysis was initial or an early symptom suggested this study. After a comprehensive review of the literature, the author reports in detail 13 cases, two of which ended fatally. He proposes the name of Landry-Guillain-Barret syndrome for this disease. The term Landry's paralysis is applied to the ascending paralysis, described by Landry. A descending paralysis that begins in the cranial nerves is another form of the same disease and most reported cases are variations of one or the other type, or are mixed. The gravity of the disease depends entirely on the extent of involvement of the respiratory or cardiac function. The etiology is unknown; all that is known is that the disease occurs in small epidemics of polyneuropathy, in which the spinal medulla, the brain stem, or the cortex may be involved. Some cases in spite of a stormy onset are surprizingly mild, while others have a high mortality. Very frequently the ophthalmologist sees the patient first because of the diplopia and it is well for him to be aware that death may ensue, with an unsuspected rapidity. (19 figures) Ray K. Daily.

Lowenstein, O., and Loewenfeld, I. E. **Mutual role of sympathetic and parasympathetic systems in reflex dilatation of the pupil; pupillographic studies.** Arch. Neurol. and Psychiat. **64**:313-340, Sept., 1950.

Section of the cervical sympathetic trunk results in immediate dilation of the homolateral pupil, followed by contraction which leads to permanent anisocoria. The dilation is due to stimulation of the severed fibers by the act of cutting. The purely parasympathetic control of sympathectomized pupils is modified by influences which develop when denervation is followed by sensitization. Active reflex dilation of the pupil is present at the moment of death on the normal side and absent on the sympathectomized side; in case of hypersensitivity to epinephrine after postglanglionic sympathectomy, the sympathectomized pupil dilates and finally reaches a larger diameter than that of the normal pupil. After sympathectomy, movements due to stimulation and relaxation of the third nerve may be stronger on the sympathectomized side than on the normal side. This is explained as a disinhibition phenomenon of the third nerve, that results from the absence from the cervical sympathetic nerve supply. This disinhibition modifies the contraction to light, which generally is more extensive on the sympathectomized side than on the normal side. This phenomenon tends to disappear on repeated stimulation with light. The secondary redilation after contraction to light is predominantly due to sympathetic influences that pass over the cervical sympathetic fibers. About four fifths of active reflex dilation is abolished when the cervical sympathetic trunk is cut.

When hypersensitivity has developed in the denervated iris, the psychosensory dilation consists of two phases: 1. slow and inextensive dilation, and 2. a slow longlasting and therefore extensive dilation. The mechanism by which sensory stimuli in the denervated iris tissue lead to dilation of the pupil is different from the mechanism of normal pupillary dilation under nervous control.

In cats in which the ciliary ganglion has been removed, weak psychosensory stimuli result in pupillary reflex dilation, both of the normal and of the parasympathectomized pupil. Parasympathetic constrictor tone increases with increasing intensity of light and decreases with

diminishing intensity of illumination. A nearly complete parasympathetic relaxation seems to occur in complete darkness. Physostigminization not only contracts the pupil but reduces and modifies all pupillary reactions, both sympathetic and parasympathetic. In the variability of sympathetic and parasympathetic tonus, a certain sympathetic-parasympathetic relation exists which is most favorable, and another which is least favorable, for the production of sympathetic or parasympathetic reflexes or both. Complete, or almost complete, absence of tonus, such as existed in cases of severed parasympathetic fibers, appears to be unfavorable to the production of active sympathetic reflexes. Physostigmine or other parasympathomimetic drugs, and parasympatholytic and sympatholytic drugs as well, generally do not favor the development of a natural and optimal sympathetic-parasympathetic relation.

Theodore M. Shapira.

Patrikios, J. S. **Ophthalmoplegic migraine.** Arch. Neurol. and Psychiat. **63**: 902-917, June, 1950.

The author reviews histories of 14 patients with ophthalmoplegic migraine, seven of whom had a history of migraine. There is no difference between the clinical features of attacks of ophthalmoplegic migraine in these two different groups. The oculomotor, facial, trigeminal, acoustic, or vagus nerve can all be affected in different patients. In some cases there is alteration of spinal fluid. Fever therapy when applied at the onset of the attack is an efficacious therapeutic method. One patient developed typhoid fever while under therapy, and the migraine disappeared. (References) Bennett W. Muir.

Pau, Hans. **Ciliary neuralgia as vegetative pain.** Klin. Monatsbl. f. Augenh. **116**: 578-583, 1950.

Injuries in the region of the ciliary body and iris and diseases like glaucoma and iritis cause pain due to alteration of the sensory limbs of the trigeminal nerve. Occasionally, however, patients complain of a severe boring pain or pressure localized in or behind the eye and of an oppressive headache. The author electrocoagulated the Gasserian ganglion of six patients for severe trigeminal neuralgia. Although the cornea became totally anesthetized, patients still complained of a very severe bursting or boring pain behind the eye and of a dull oppressive headache. Since the sensory branches of the trigeminal had been excluded the pain can have been caused only by the vegetative nervous system, the sympathetic. R. Grunfeld.

Rucker, C. W. **Sex-linked nystagmus associated with red-green color-blindness.** Am. J. Human Genetics **1**:52-54, Sept., 1949.

A special type of nystagmus associated with red-green blindness is discussed for the first time. This condition is hereditary, and the pedigree of the family is given. The investigators had previously reported another family from southern Minnesota in which like nystagmus occurs. The nystagmus in both families is a sex-linked character.

Donald T. Hughson.

Woywitka, N. W., and Riches, J. V. **Amaurosis in whooping cough.** Canad. M. A. J. **63**:272-273, Sept., 1950.

The two case histories presented show that the various signs, symptoms and tests point toward brain involvement. When cerebral irritation was most marked, during the early stage of the disease, the pupils were dilated and fixed. After the convulsions were controlled the pupils became normal in size and reaction. Subsequent eye findings were negative except for amaurosis. The authors concluded that the optic nerves, chiasm

and tracts were not affected, and believe that the bilateral amaurosis was due to an acute toxic encephalitis with cerebral edema, a complication of whooping cough. In autopsies performed on pertussis patients, edema and petechial hemorrhages have been frequent pathologic findings. Theodore M. Shapira.

14

EYEBALL, ORBIT, SINUSES

Arjona, J. **Discussion of Basedow's disease.** Arch. Soc. oftal. hispano-am. **10**: 443-452, May, 1950.

A case of pronounced exophthalmos with exposure keratitis, in a man, 35 years old, without hyperthyroidism, is reported. The exophthalmos was controlled by blepharorrhaphy, irradiation of the pituitary and estrogenic hormones. The literature on this type of exophthalmos is reviewed. (1 figure)

Ray K. Daily.

Contino, Filippo. **Pulsating exophthalmos due to orbital hemorrhage.** Rassegna ital. d'ottal. **19**:196-208, May-June, 1950.

A 56-year-old man received a moderately severe, accidental blow from a child's hand on the left eye. Almost immediately, there was severe pain in and about the eye, accompanied by dizziness and soon thereafter protrusion of the globe. The exophthalmos measured 9 mm. and the intraocular pressure 45 mm. The patient was healthy, with blood pressure 150/100 and careful studies of the blood, urine, and X rays of the skull, were negative. Pulsation of the globe could be determined by palpation and a bruit was heard with the stethoscope. Compression of the carotid artery in the neck reduced the pulsation in part. The pulsating exophthalmos was evidently due to an endo-orbital hemorrhage. The ultimate fate of the eye was unknown.

Eugene M. Blake.

Converse, J. M., and Smith, B. **Reconstruction of the floor of the orbit by bone grafts.** Arch. Ophth. **44**:1-21, July, 1950.

Conditions that produce distortion or loss of the floor of the orbit are reviewed. Deformity, orbital disturbances and diplopia result from disorganization or loss of the orbital floor. Clinical and roentgenographic methods of evaluation of the deformity are discussed. The technique of reconstruction of the floor of the orbit by autografts and homografts of bone is described in 14 cases in which it was successful. R. W. Danielson.

Drescher, E. P., and Benedict, W. L. **Asymmetric exophthalmos.** Arch. Ophth. **44**:109-128, July, 1950.

Exophthalmometric measurements (Hertel) of 100 normal subjects fell within a range of 10 to 24 mm., with a mean of 17.3 mm. The maximal normal asymmetry of the eyes was 2.0 mm. One hundred and seventy-seven cases of asymmetric exophthalmos were reviewed. In 44 percent of this total the exophthalmos was neoplastic in origin; in 43 percent, non-neoplastic, and in 13 percent the cause was not diagnosed. Asymmetry of the two eyes in excess of 7 mm. is found to be uncommon in exophthalmic goiter. Data are presented in support of the view that the less prominent of the two eyes is also involved in the exophthalmos of exophthalmic goiter. Thus it is believed that, although the proptosis may be asymmetric, it is rarely unilateral.

R. W. Danielson.

Gimenez Ruiz, R. **A contribution to oribital pathology.** Arch. Soc. oftal. hispano-am. **10**:861-864, Aug., 1950.

Two unusual cases are reported, one of retrobulbar gumma, in which pain was the dominating symptom and the other of fracture of the floor of the left orbit, produced by a fall from a tree, and followed by an extensive retrobulbar

hemorrhage with marked exophthalmos, ocular immobility and conjunctival chemosis. Evacuation of the blood by aspiration with a needle resulted in prompt relief of symptoms. (1 figure)

Ray K. Daily.

Knapp, F. N., and Knoll, W. V. **Sarcoid involving the orbit.** Tr. Am. Ophth. Soc. **47**:147-157, 1949.

A case of sarcoid involving the orbit is reported. Sarcoidosis may involve many tissues in the same individual or only a single site. Its etiology is still undetermined. Sarcoid-like nodules may develop after trauma. Phosphatides may be the cause of epithelioid cell formation and silicia and beryllium are the cause of epithelioid cell reactions. There may be causes for sarcoidosis other than tuberculosis. David Harrington.

Lopez Dominguez, B. **Orbital implants.** Arch. Soc. oftal. hispano-am. **10**:865-870, Aug., 1950.

The costliness of plastic orbital implants prohibits their experimental use in Spain. Ray K. Daily.

15

EYELIDS, LACRIMAL APPARATUS

Carreras Matas, Marcelo. **Supernumerary lacrimal punctum.** Arch. Soc. oftal. hispano-am. **10**:393-396, April, 1950.

The congenital supernumerary lacrimal opening in the left lower lid of a 50-year-old woman had the appearance of a dehiscence in the upper wall of the lacrimal canaliculus, rather than an actual punctum. The literature is briefly reviewed. (1 figure) Ray K. Daily.

Koke, M. P. **Treatment of occluded nasolacrimal ducts in infants.** Arch. Ophth. **43**:750-754, April, 1950.

Salient differences of opinion expressed in the literature concerning the treatment of occluded nasolacrimal ducts are presented. The author reports excellent results from the early irrigation and probing of the ducts. To probe the nasolacrimal duct is not a radical procedure. It can be done in the office without general anesthesia. There is no justification for permitting symptoms of congenital occlusion to persist more than one month. The use of general anesthesia in probing the duct of a child 12 months or younger is unnecessary, expensive and dangerous.

John C. Long.

Magni, S. **Ocular manifestations in xeroderma pigmentosum.** Boll. d'ocul. **29**: 84-96, Feb. 1950.

Three patients with this rare disease, two young girls and a man 24 years old, were observed. The skin lesions of the face involved the lids and, in some of the eyes, the conjunctiva. Biopsies revealed the characteristic lesions. Plesioröntgentherapy was effective in all three patients. The importance of early diagnosis is stressed; by attacking the neoplastic lesions before they become malignant one may save the lives of many of these patients. (8 figures, 18 references).

K. W. Ascher.

Suarez Villafranca, M. R. **Plastic surgery of the lids with free grafts.** Arch. Soc. oftal. hispano-am. **10**:851-860, Aug., 1950.

The author uses free grafts from the forearm for filling defects, cicatricial ectropion, restoration of the orbital or conjunctival cavity and reconstruction of the lower lid. He describes an appliance which he designed for stretching the skin of the forearm and facilitating the excision of the graft, and a forceps for holding the graft and tying sutures. The stretcher consists of two wide bracelets, one of which is movable, attached to a vertical bar; the part of the bracelets adapted to the anterior surface of the fore-

arm has ten small teeth, which fix the skin. (11 figures) Ray K. Daily.

16
TUMORS

Contino, F. **Sturge-Weber syndrome, incomplete, with angiomatosis of the choroid.** Boll. d'ocul. **29**:133-155, March, 1950.

An eleven-year-old boy had unilateral glaucoma, extensive ipsilateral facial nevus flammeus and a choroidal hemangioma. Enucleation of the glaucomatous eye was performed and the microscopic findings are described. (6 figures, references) K. W. Ascher.

Davies, C. E. **Modern methods for treatment of malignant tumors of the eye.** Canad. M.A.J. **62**:568-571, June, 1950.

For malignant melanoma of the iris, wide iridectomy is recommended when the tumor is confined to the pupillary area, but when the iris base is involved enucleation with radium bomb implant is preferred. Frequent observation of choroidal naevi for possible malignant changes is advisable. In malignant melanoma of the choroid, enucleation with a maximal optic stalk is preferred. If there is evidence of extraocular growth, the author prefers enucleation followed by the insertion of a radium bomb to exenteration of the orbit. Malignant melanoma of the bulbar conjunctiva is treated by wide excision followed by beta irradiation. Retinoblastoma is bilateral in at least one out of every four cases. When unilateral, intracranial section of the optic nerve distal to the chiasm, followed by enucleation in about two weeks is recommended. For bilateral tumors enucleation of one eye with some form of irradiation of the other is preferred. Only palliative care is recommended in metastatic carcinoma.

Benjamin Milder.

Fralick, F. B., and Wilder, H. C. **Intraocular diktyoma and glioneuroma.** Tr. Am. Ophth. Soc. **47**:317-324, 1949.

The clinicopathologic features of an additional case of congenital diktyoma are reported. This locally malignant tumor of the nonpigmented epithelium of the ciliary body was associated in this case with an intraocular glioneuroma, an even rarer tumor of nervous origin.

David Harrington.

Gonzalez, Vanrell F., Pateyro, P., and Grosso, O. **Value of cytologic examination in the diagnosis of choroidal melanoma.** Arch. Soc. oftal. hispano-am. **10**: 579-591, June, 1950.

The literature on choroidal melanoma is briefly reviewed and a case reported. The clinical diagnosis was made by a cytologic examination of the fluid withdrawn by a puncture in the area suspected of the malignant tumor. The fluid was stained with May-Grunwald-Giemsa stain, and malignant cells containing melanin were found. The enucleated eye was examined histologically and the diagnosis was confirmed. It is believed that a cytogram of the fluid obtained by a puncture with a fine needle may be of value in the diagnosis of intraocular tumors. (12 figures) Ray K. Daily.

Limón, J. N. **Radiotherapy in carcinoma of the lids.** An. Soc. mex. de oftal. **23**:129-142, July-Sept., 1949.

The author prefers surgery or radiation to other forms of treatment. There is permanent loss of lashes of the area irradiated. The lens is very easily affected by radiation. The literature of the subject is reviewed. In the author's series of 33 cases in three years 22 have been controlled. (6 figures) W. H. Crisp.

Remler, O., and Pieck, K. **The ophthalmologic changes in tuberous sclerosis.** Klin. Monatsbl. f. Augenh. **116**:522-536, 1950.

The author describes three cases of tuberous sclerosis. One patient with binasal hemianopia came to autopsy. A ventricular tumor was found. The author reviews the literature and describes the histologic picture of the retinal, ventricular, and cortical tumors. The peculiarity of this disease lies in a circumscribed overproduction of a certain kind of tissue, originating directly from the germtissue, accompanied by inhibition or underdevelopment and loss of function of tissues the tumor has displaced. (5 figures) R. Grunfeld.

17

INJURIES

Chavira, R. A. **Diagnosis and treatment of intraocular foreign bodies.** An. Soc. mex. de oftal. **23**:172-190, July-Sept., 1949.

Twenty-seven cases are summarized; in 4 the foreign body was in the iris, in 2 in the sclera, in 1 in the anterior chamber, in 1 in the retina, in 1 in the lens, in 1 retroocular, and in 2 in the vitreous. In nearly all these cases the hand magnet was used. Three cases of sympathetic ophthalmia were encountered. Vergara's technique of localization by means of needles placed at the limbus is regarded as a real advance. (References)

W. H. Crisp.

18

SYSTEMIC DISEASE AND PARASITES

Amo Molina, Antonio. **Charlin's syndrome.** Arch. Soc. oftal. hispano-am. **10**:397-400, April, 1950.

The triad of symptoms, inflammation of the anterior segment, rhinorrhea and neuralgia in the region of the orbit, which constitute the Charlin syndrome, is briefly reviewed and four cases which were seen in less than a month are reported. Ray K. Daily.

Bassen, F. A., and Kornzweig, A. L. **Malformation of the erythrocytes in a case of atypical retinitis pigmentosa.** Blood **5**:381-387, April, 1950.

The authors report the case of an 18-year-old girl who showed a clinical picture of Friedrich's ataxia, associated with an atypical retinitis pigmentosa and abnormalities of the circulating erythrocytes. One brother had similar ocular and red blood cell findings, and there was a history of consanguinity. Visual impairment, with night blindness, had been noted at 6 years of age. There were signs of retinitis pigmentosa, with pigmented lesions in each macula and surrounding the optic discs. Examination of the visual fields showed a ring scotoma and a central scotoma. The red blood cells were irregular and crenated. The unusual association of the abnormality of the red cells with the picture of retinitis pigmentosa and Friedrich's ataxia has not been reported before.

Benjamin Milder.

Dolcet Buxeres, Luis. **The ocular fundus in children with tuberculous meningitis.** Arch. Soc. oftal. hispano-am. **10**: 342-350, April, 1950.

The tabulated ocular symptoms observed in 63 children with tuberculous meningitis and treated with streptomycin were studied. A fundus examination is of diagnostic value in tuberculous meningitis, because of the early occurrence of ocular symptoms. Most frequent are changes in the optic nerve, then choroidal tubercles and pupillary disturbances. Systematic fundus study is also of prognostic value. The regression of a choked disc is a good prognostic sign whereas the progress of papillitis from edema to choked disc is unfavorable. When a tubercle of the choroid diminishes in size and becomes circumscribed and pigmented at the margins, the prognosis is favorable. The appearance of new choroi-

dal foci is a definite sign of progression of the disease and probably of impending death. Disappearance of pupillary disturbances, even if the disturbances of ocular motility persist, is a good sign. The question of toxicity of streptomycin and its effect on the optic nerve is still a subject of investigation.

Ray K. Daily.

Garcia, Beiras. **Cysticercus in the vitreous.** Arch. Soc. oftal. hispano-am. **10**:786-791, Aug., 1950.

The 42-year-old patient had what she thought was a recurrence of iritis, having had an attack two years previously. An ophthalmoscopic examination revealed a tense-appearing globular structure in the lower portion of the vitreous behind the lens. An atrophic chorioretinal area was present on the nasal side. The author made the diagnosis of a subretinal cysticercus, which ruptured into the vitreous. The patient was found to have intestinal Tenia saginata. The intraocular parasite was extracted with forceps under ophthalmoscopic observation through a scleral incision. The eyeball subsequently atrophied. The pathogenesis of the lesions and the life cycle of the parasite within the human body is discussed. (1 figure in color) Ray K. Daily.

Hepburn, R. H. **Reiter's syndrome treated successfully with dihydrostreptomycin.** J. Urology **64**:413, Aug., 1950.

A case of Reiter's syndrome consisting of severe conjunctivitis, arthritis involving the knees, and purulent urethritis in a 16-year-old boy responded promptly to dihydrostreptomycin after aureomycin and mapharsen had failed.

Irwin E. Gaynon.

Van Heuven, J. A. **Ocular manifestations of sarcoidosis.** Am. Practitioner **1**: 619-623, June, 1950.

The author reviews briefly the general characteristics of sarcoidosis, emphasizing the great variety of signs and symptoms which are encountered. The eye findings are limited chiefly to the conjunctiva and the uveal tract, and can be found in 5 to 10 percent of all cases of sarcoidosis. The conjunctival findings consist chiefly of nodules and occasionally a coxcomb type of inflammatory reaction. The follicles show lymphocytic infiltration and epithelioid cells. Conjunctival ulceration does not occur, and the affection is bilateral.

Iritis is characterized by moderate bulbar injection, small nodules on the surface of the iris and deposits in the anterior chamber. The diagnosis of uveitis due to sarcoidosis is rendered more probable by the concurrent findings of parotitis, moderate temperature elevation, swelling of other glands and of lymph nodes, and peripheral neuritis. Lesions in the choroid are more rare than iritis but have been reported. Perivasculitis has been described, sometimes associated with retinitis proliferans. Other ocular findings have been attributed to sarcoidosis. These include optic neuritis, paralysis of the oculomotor nerve and of the iris sphincter. Illustrative case reports are presented, and the author discusses the theories of etiology of Boeck's sarcoid. Benjamin Milder.

Kantar, B. L. **Diabetic retinopathy.** Bull. Univ. Minnesota Hosp. **21**:352-360, April 17, 1950.

Of all the lesions seen in the pathologic fundi of diabetics, the small red spots in the presence of normal arterioles are the most common. Previously thought to be small hemorrhages, it is now certain that a large number of them are capillary aneurysms. Ophthalmoscopically the retinal changes observable are microaneurysms, hemorrhages, exudates, venous changes and proliferation. Any of these may occur with or without arteriolar

changes. Where arteriolar changes, especially focal arteriolar narrowing, are present, with these other lesions, we have a mixed vascular diabetic retinopathy, one in which hypertension is usually associated with the diabetes. Capillary fragility is greatly increased in the diabetic with retinopathy and the results of treatment for reducing this fragility have not been very satisfactory.

The capillary and venous changes may be an attempt to relieve the tissues which are affected by poor nutrition and low oxygen supply.

Intercapillary glomerulosclerosis or Kimmelstiel-Wilson disease, which more or less regularly occurs with more advanced types of diabetic retinopathy cannot be absolutely diagnosed but should be suspected in long standing diabetes mellitus associated with albuminuria, renal insufficiency and diabetic retinopathy of advanced type.

Francis M. Crage.

Krause, A. C. **Ocular toxoplasmosis.** Ophth. ibero-am. **12**:1 (English, p. 1 to 12; Portuguese, 13 to 24).

These highly organized protozoa have been confused with Leishmania, Sarcosporidia, Plasmodia, and Histoplasma. The disease has been found spontaneously in the dog, cat, rat, sheep, guinea pig, and a number of other animals. The one species seems capable of infecting many hosts, but is probably generally distributed throughout the world. Recent investigations suggest that the disease is commoner among mankind than ophthalmologists have realized. The most probable manner of transmission is by infected secretions and excretions. The clinical symptoms and signs in infantile toxoplasmosis are internal hydrocephalus, convulsions, spasticity, opisthotonus, head retraction, and paralysis. The characteristic ocular lesion is an area of chorioretinitis. At the University of Chicago clinics numerous patients with internal eye disease are seen as consultative cases. (6 figures, references)

W. H. Crisp.

Kumm, G., Mehlhose, F., and Obal, A. **Eye findings in juvenile diabetics.** Klin. Monatsbl. f. Augenh. **116**:482-498, 1950.

Among 160 juvenile diabetics 33 exhibited retinal disturbances. Seventeen patients had punctate hemorrhages, 7 had waxy exudates and 9 had both. The retinal disturbances are more often seen in light than in severe diabetes. The duration of the disease was less than 10 years in 12 patients and of only a few months in two. The blood pressure in juvenile diabetics is usually lower than normal. The hypertension in old diabetics seems, therefore, to be a secondary complication. Aimless insulin-therapy, frequent changes in the dosage and abstinence lead to capillary damage and to vascular retinal lesions.

In 11 among 176 juvenile diabetics bilateral lens opacities were found which were ascribed to diabetes. Three patients had the so called snowstorm cataract. No relation could be detected between cataract formation and blood sugar level and insulin therapy did not resolve opacities.

The authors found transitory myopia in 66 cases. This high incidence might be ascribed to the fact that patients during the war received insufficient or no insuline therapy. Disturbed mineral balance in diabetics causes osmotic pressure changes in the lens leading to increase of volume of the lens fibers and to alteration of curvature of the lens surface and to myopia. The author observed radial figuration in the retinal reflex during skiascopy of 60 percent of the myopes and in 20 percent of the transitory hyperopes, when fully corrected. This may be of diagnostic significance. Slitlamp examination has not revealed any alteration in the lens fibers. R. Grunfeld.

Lake, M. S., and Kuppinger, J. C. **Craniofacial dysostosis (Crouzon's disease): report of three cases.** Arch. Ophth. **44**:37-46, July, 1950.

An attempt is made to classify the main groups of the cranial stenoses in a brief and usable manner. A short discussion of the etiology and the typical clinical and roentgenologic findings of craniofacial dysostosis is given. Emphasis is laid on the need of early diagnosis and neurosurgical treatment in order to forestall eventual catastrophe. Three case histories are cited which give proof of the hereditary nature and separate classification of this group of the cranial stenoses. The propriety of parenthood for afflicted persons is questionable.

R. W. Danielson.

Lewis, Nancy. **Intraocular involvement in a case of xanthomatous biliary cirrhosis.** Brit. J. Ophth. **34**:506-508, Aug., 1950.

Intraocular changes in a patient with xanthomatous biliary cirrhosis are described. The patient complained of decreasing vision of the right eye for six months. In the fundus large yellowish masses could be seen in strata deeper than the retinal vessels. It was assumed that these were xanthomata similar to those elsewhere in the body.

Orwyn H. Ellis.

Lewis, Nancy. **Ocular manifestations of sarcoidosis with a description of seven cases.** M. J. Australia **2**:582-585, Oct. 14, 1950.

The most common lesion in ocular sarcoidosis is iridocyclitis. An aqueous flare and keratic precipitates are often the cause of the first symptom which is blurring of vision. In patients with uveitis and facial paralysis there was no enlargement of the parotid glands (unlike Heerfordt's syndrome). The iris was atrophic in its inner third in long standing cases. Sarcoidosis should be considered in all cases of iridocyclitis especially when there are the mutton-fat type of keratic precipitates, nodules in the iris or Koeppe's nodules on the pupillary margin. In this series the eyes withstood surgery well which, on the whole, was followed by good vision. Calciferol and routine treatment for iridocyclitis should be given.

H. C. Weinberg.

Maignien-Courard. **Ocular manifestations of one form of rheumatic disease. The syndromes of Fiessinger-Leroy and Reiter.** Ann. d'ocul. **183**:660-683, Aug., 1950.

The syndromes of Fiessinger-Leroy and Reiter are respectively the French and the English-German names for the same disease pattern. The gastro-intestinal tract, eyes, joints and urethra are most frequently involved. Less often the integumentary, metabolic, and cardiovascular systems are affected. The ocular manifestations include anterior uveitis and purulent conjunctivitis which are frequently bilateral and recurrent. The lesion of the joints are multiple and usually involve the knees. The inflammation of the urethra, like that of the other covering membranes, is usually purulent and nongranulomatous. No primary causative organism has been isolated in smears or cultures. Especially in the French cases the first manifestation of the syndrome is a gastroenteritis, which may be bacillary, protozoal or viral. In several days or weeks the other parts of the disease pattern develop with varying intensity. Pathologically the process is primarily a seropurulent nongranulomatous inflammation which affects predisposed local areas of the covering membranes. The causation is probably not a single organism or toxin but may be one of a group of organismal toxins which usually enter the body through the gastrointestinal tract. The author reviews the litera-

ture and presents three cases which emphasize the importance of the primary gastrointestinal involvement.

Chas. A. Bahn.

Manzitti, E., and Anselmo, F. B. **A case of ophthalmoplegic migraine.** An. Soc. mex. de oftal. **23**:191-196, July-Sept., 1949.

An attack of migraine with lid redness and marked edema of the lid, in 1938, was succeeded by third nerve paralysis, first in the left eye and another attack three months later by a similar paralysis in the right eye. Persistent paralysis of the left third developed in 1943, with constant nausea and vomiting. Each attack followed months of freedom.

W. H. Crisp.

Mata, Pedro. **Brigger's theory on the pathogenesis of tuberculosis and its application to ocular tuberculosis.** Arch. Soc. oftal. hispano-am. **10**:327-331, April, 1950.

Brigger's theory on the pathogenesis of tuberculosis is summarized. Ocular lesions, like lesions elsewhere, pass through the three stages of evolution, and the final stage of clinical manifestation is preceded by a long period of silent and clinically unrecognized activity. If, as Brigger maintains, the most favorable time for therapy is this symptomless period, it is important that the diagnosis be made then. It is therefore urged that patients with tuberculosis be examined by all possible methods to discover all foci, which, although clinically inactive, are active biologically and are in the most favorable phase for successful therapy. Ray K. Daily.

Prado, Durval. **Oculocephalic pain.** Arq. brasil de oftal. **13**:93-98, 1950.

The causes of migraine. are briefly enumerated. W. H. Crisp.

Puig Solanes, M., Heatley, J., Arenas, F., and Guerrero, G. **Ocular complications in brucellosis.** An. Soc. mex. de oftal. **23**:223-229, Oct.-Dec., 1949.

In 87 patients with brucellosis taken at random from the Mexican medical department, 15 showed involvement of the visual apparatus. The neuraxon and uvea were the structures most frequently involved. (References) W. H. Crisp.

Reinberg, M. H. **Progressive muscular dystrophy associated with retinitis pigmentosa.** Calif. Med. **73**:266-267, Sept., 1950.

The author mentions literature which suggests a relationship between these diseases and presents a case in which both diseases were combined but in which no clinical evidence of endocrinopathy was demonstrated. Each of these diseases in certain instances has been associated with pituitary dysfunctions but in this case there was nothing more suggestive of endocrine disturbance than a low fasting blood sugar.

Theodore M. Shapira.

Rosenthal, J. N. **Oculoglandular tularemia.** New Orleans M. and S. J. **102**: 558-566, May, 1950.

The complete medical picture of oculoglandular tularemia is described, including the various diagnostic procedures to be followed in differentiating the disease from other causes producing similar symptoms. Donald T. Hughson.

Sanchez Mosquera, M. **A report of a case of endocular cysticercus.** Arch. Soc. oftal. hispano-am. **10**:777-785, Aug., 1950.

The diagnosis was made ophthalmoscopically. The man, 38 years old, complained of cloudy vision of one month's duration. The cysticercus was extracted through the sclera by the technique used for extraction of foreign bodies; after the ocular envelope was opened the

cysticercus herniated spontaneously through the incision. The post-operative course was normal, and the result was a blind eye, with a satisfactory appearance. Fundus photographs illustrate the aspect of the parasite, and a detailed description of the photographic arrangement for taking the pictures is presented. (5 figures)

Ray K. Daily.

Somerville-Large, L. B. **A case of permanent blindness due to toxemia of pregnancy.** Brit. J. Ophth. **34**:431-434, July, 1950.

Permanent blindness due to toxemia of pregnancy is extremely rare. Only one other case has been recorded and there was no case in over 150,000 births reviewed in this report. This patient was 26 years old and had moderately severe eclampsia in the 35th week of the her sixth pregnancy. The other pregnancies had been uneventful. By Caesarean section she was delivered of a normal baby. Paralytic ileus followed and the patient was ill for several months, but was generally well on discharge.

Two weeks before admission she had noted diminution of vision which progressed rapidly. On admission vision was totally absent in the right eye and in the left was reduced to counting of fingers. Both fundi showed severe edema of the disc, retinal detachment below, numerous hemorrhages and exudates and marked angiospasm. The detachments healed well but the other changes remained. Both discs presented advanced atrophy and the patient was blind. A diagnosis of bilateral total transverse neuritis was made. This neuritis was probably due to severe angiospasm of the central artery and occurred near the nerve head, which accounts for the marked papilledema. Reduced vision, retinal separation and papilledema are not uncommon during toxemia of pregnancy but normally these abnormalities disappear.

Morris Kaplan.

Soria. **Lesions of the fundus in toxoplasmosis.** Arch. Soc. oftal. hispano-am. **10**:478-483, May, 1950.

The literature is reviewed and four cases are reported. The diagnosis was confirmed serologically in a mother and child with unilateral involvement, and in an infant four months old with bilateral involvement. The fourth patient, 40 years old, had typical bilateral lesions, which could be confused with macular coloboma; a serologic study was not made.

Ray K. Daily.

19

CONGENITAL DEFORMITIES, HEREDITY

Burn, R. A. **Further cases of a fundus dystrophy with unusual features.** Brit. J. Ophth. **34**:393-403, July, 1950.

In 1949 Sorsby and Mason described for the first time a familial type of fundus dystrophy and suggested that it most probably was a new clinical entity. Burn reports the study of three generations of another family. The disease is a central fundus lesion coming on in the late forties, of genetic origin and dominant transmission, progressing to central blindness but leaving peripheral vision free up to an advanced age. In all these patients studied, the disease appeared between the ages of 45 and 55 years as a rather sudden diminution of central vision which progressed steadily in about five years to central blindness and in each case peripheral vision remained good. The lesion began with central pigmentary mottling which progressed into a large white scar with masses of pigment and then into extensive choroidal atrophy. The discs, vessels, and a marginal zone of retina remained normal. The lesion must be differentiated from severe central choroiditis. The condition was inherited di-

rectly as a dominant characteristic. (14 figures) Morris Kaplan.

Lowe, R. F. **The arcuate lens opacities of mongolism and cataracts of similar appearance.** Brit. J. Ophth. **34**:484-488, Aug., 1950.

Arcuate lens opacities of mongolism are described and illustrated in color. When some of the capsulopupillary vessels are hypoplastic during the critical period of lens nutrition from the eighth to the sixteenth week of embryonic life, the cells dependent upon these vessels for their nutrition are damaged. In mongolism the disturbance may be sufficient to interfere with the ability of the equatorial cells to form clear lens fibers, thus a sector opacity is produced without coloboma formation. These opacities correspond to the development period of about eight-and-one-half to nine weeks. It is possible that some of the other stigmata of this syndrome may be dependent upon abnormalities of early blood supply. Orwyn H. Ellis.

Norton, H. W. **Estimation of linkage in Rucker's pedigree of nystagmus and colorblindness.** Am. J. Human Genetics **1**:55-67, Sept., 1949.

A very complicated mathematical analysis of genetic data is presented, using nystagmus associated with red-green color blindness as an example.

Donald T. Hughson.

Salvi, G. L. **Ocular ochronosis alcaptonurica.** Boll. d'ocul. **29**:164-172, March, 1950.

A 65-year-old man and his 79-year-old brother, belonging to a family of alcaptonurics, showed ochronosis of the skin of the lid and the bulbar conjunctiva. Simple chronic glaucoma was present in both eyes of each of the brothers. The author was unable to find any reference to the simultaneous occurrence of bilateral glaucoma and ocular ochronosis; he discusses the possibility that pigment might have obstructed the aqueous veins of these eyes but he could not exclude mere coincidence. K. W. Ascher.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Ashton, Norman. **Museum mounting in ophthalmology.** Brit. J. Ophth. **34**:451-456, July, 1950.

Transparent plastic materials are completely displacing glass as a medium of mounting pathologic specimens in museums. At the Institute of Ophthalmology all the specimens are being remounted and recatalogued. Ashton describes in detail the technical procedures for mounting museum specimens in transparent plastic boxes and in solid plastic and solid resin mountings. (8 photographs)

Morris Kaplan.

Conde, Herminio. **Legislation relating to the prevention of blindness.** Rev. brasil. oftal. **9**:27-36, Sept., 1950.

Brazilian law is cited which permits measurement of refraction only by physicians. W. H. Crisp.

De Farias, Natalicio. **The concept of blindness.** Rev. brasil. oftal. **9**:15-17, Sept., 1950.

This brief paper emphasizes the concept of blindness in relation to 1. the diseases which cause blindness, 2. the practice of a trade or profession, and 3. the calculation of indemnity for occupational accident. W. H. Crisp.

DeRoetth, Andrew, Sr. **The blind baby.** Northwest. Med. **49**:380-382, June, 1950.

The causes of blindness in infants and young children are discussed. The diseases are separated into those which are truly congenital and those which occur in very early postnatal life.

Donald T. Hughson.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received by the editor at least three months before the date of occurrence.

SPANISH ABSTRACTOR WANTED

The JOURNAL is in need of an abstractor to review Spanish periodicals. For further information please write the abstract editor: Dr. F. Herbert Haessler, 561 North 15th Street, Milwaukee 3, Wisconsin.

ANNOUNCEMENTS

TO GIVE ORTHOPTIC COURSE

The Washington University School of Medicine announces a full-time course in orthoptic technology. It will be given annually. The next course begins September 17, 1951, and extends to June 15, 1952.

Both didactic and practical training are given in orthoptic technology and a certificate is granted upon successful completion of the course. Tuition is $350.00.

Facilities for instruction include the Motility Clinic of the Washington University Clinics and the St. Louis Ophthalmic Laboratory, the latter under the direction of Miss Anita Stelzer. The course is limited to eight students.

Applicants must be at least 18 years of age and high school graduates, preferably with at least one year of college.

Inquiries and applications should be addressed to Dr. Richard G. Scobee, director of graduate training in ophthalmology, 640 South Kingshighway, Saint Louis 10, Missouri.

ASSOCIATE WANTED

An opening occurs in Washington, D.C. for a competent ophthalmologist to be associated with an ophthalmologist in a large private practice and the George Washington University Medical School. The appointment comprises private practice and teaching, and research if so desired by the applicant. Application should be made to Mrs. R. McKenzie Ross, Room 2166, Department of Ophthalmology, George Washington University Hospital, Washington 7, D.C.

HELMHOLTZ EXHIBIT

An exhibit honoring Hermann von Helmholtz, the inventor of the ophthalmoscope, is being displayed under the auspices of the Medical Museum of the Armed Forces Institute of Pathology and the Army Medical Library in the Armed Forces Medical Museum at 9th and Independence Avenue, S.W., Washington, D.C. The exhibit which opened on December 17, 1950—the date that marks the 100th anniversary of Helmholtz' letter to his father describing the instrument which was to enable doctors to see the interior of the human eye for the first time—will continue for six months.

MISSISSIPPI VALLEY ESSAY CONTEST

The 11th annual essay contest of the Mississippi Valley Medical Society will be held in 1951. The Society will offer a cash prize of $100.00, a gold medal, and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics and education) and practical value to the general practitioner of medicine. Certificates of merit may also be granted to the physicians whose essays are rated second and third best. Contestants must be members of the American Medical Association who are residents and citizens of the United States.

The winner will be invited to present his contribution before the 16th annual meeting of the Mississippi Valley Medical Society to be held in Peoria, Illinois, September 19, 20, and 21, 1951, the society reserving the exclusive right to first publish the essay in its official publication—the *Mississippi Valley Medical Journal* (incorporating the *Radiologic Review*).

All contributions shall be typewritten in English in manuscript form, submitted in five copies, not to exceed 5,000 words, and must be received not later than May 1, 1951. Further details may be obtained from Dr. Harold Swanberg, 209-224 W.C.U. Building, Quincy, Illinois.

INTENSIVE ORTHOPTIC COURSE

The American Orthoptic Council will present its fourth annual intensive course in orthoptics in Boston from July 5 through August 31, 1951. Tuition is $150.00.

The course is designed to present the necessary basic didactic instructions for students together with some practical instruction in order to prepare the student to complete a course of practical training and experience offered at various orthoptic centers over the country. The council will make an effort to see that all students enrolled in the course have places to complete their practical training following the course.

Applicants must be at least 18 years of age, have had a high school education, and be sponsored by an ophthalmologist. A few scholarships are available to students from the Delta Gamma Fraternity Project.

Inquiries and applications should be addressed to the American Orthoptic Council, Dr. Richard G. Scobee, 640 South Kingshighway, Saint Louis 10, Missouri.

DELTA GAMMA SCHOLARSHIPS

The Delta Gamma Fraternity has a $1,500 annual fund, and a $2,000 revolving loan fund from which smaller scholarship awards are available to those intending to become (1) orthoptic technicians, (2) teachers of partially seeing children, or (3) specialists for blind preschool children. Anyone wishing to specialize in one of these fields may be eligi-

ble for assistance, the amount in each case to be determined by the particular need and costs involved.

If you wish to enroll for training in classification (1) please apply to Mrs. H. V. Draheim, 19641 Coral Gables, Route 18, Birmingham, Michigan; for classification (2) and (3) please write Mrs. Thomas Johnson, 1235 Longfellow, Detroit 2, Michigan.

Applications for scholarships should be filed four months prior to the start of the desired course. Applicants with basic preparation in teaching, nursing, social work, nursery education, or related fields are eligible to apply. The scholarships are intended only for the courses directly relating to the field of sight conservation and aid to the blind.

Candidates are selected with the advice of a professional committee: Chairman, Dr. LeGrand H. Hardy, of the American Orthoptic Council; Mrs. Virginia Smith Boyce, assistant director, National Society for the Prevention of Blindness; Miss Ruth E. Lewis, professor of social work, George Warren Brown School of Social Work, Washington University; Dr. Berthold Lowenfeld, superintendent of the California School for the Blind; Miss Ruth B. McCoy, assistant director, New York State Commission for the Blind; and Dr. Lillian Ray Titcomb, president of the executive committee, Nursery School for the Visually Handicapped Children of Los Angeles.

Midwest Research meeting

The third annual meeting of the Midwest Section of the Association for Research in Ophthalmology will be held at the University Hospitals, Iowa City, Iowa, on Monday, March 19, 1951. The program will consist of presentation of about eight papers, the exact titles of which will be announced later. Anyone interested is cordially invited to attend and participate in this meeting.

On the two days following, a symposium on "external diseases of the eye" will be presented by the Department of Ophthalmology, University of Iowa.

Saint Louis officers

Officers of the St. Louis Ophthalmic Society, for the year 1950-51 are: Dr. J. M. Keller, president; Dr. William H. Meinberg, vice-president; Dr. A. G. Boldizar, treasurer; Dr. Robert D. Mattis, editor; Dr. B. Milder, secretary.

Egyptian meeting

The annual meeting of the Ophthalmological Society of Egypt will take place at the Memorial Ophthalmic Laboratory, Giza, Egypt, on Thursday and Friday, March 15 and 16, 1951, at 9 A.M. Medical practitioners, oculists or otherwise, are cordially invited.

Washington, D.C., society

The Washington, D.C., Ophthalmological Society held its first meeting of the 1950-51 season on November 6, 1950. The speaker was Dr. Richard Townley Paton of New York, who spoke on "Corneal surgery."

The officers of the society for the year 1950-51 are Dr. Thomas A. Egan, president; Dr. Everett S. Caldemeyer, vice-president, in charge of program; Dr. Joseph Dessoff, secretary-treasurer; Dr. J. Spencer Dryden and Dr. J. Thomas Schnebly, members of executive board.

College of Surgeons sectional meetings

The second of a series of seven sectional meetings of the American College of Surgeons will be held in Hot Springs, Virginia, on February 26th and 27th with headquarters at The Homestead. Attendance will be largely from Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, Washington, D.C., and West Virginia, although there is no geographic restriction. The first sectional meeting was held in Saint Louis, Missouri, January 22nd and 23rd. The other five sectional meetings will be held in Philadelphia, March 5th and 6th; New Haven, March 16th and 17th; Portland, Oregon, March 26th and 27th; Denver, April 6th and 7th, and Detroit, May 10th and 11th.

The medical profession at large and medical students are invited to join with the fellows of the College in the meetings which will be addressed by nationally prominent visiting and local speakers.

Oxford congress

The next meeting of the Oxford Ophthalmological Congress will be held in Oxford on July 5, 6, and 7, 1951. The Doyne Lecture will be delivered by John Foster, F.R.C.S., of Leeds, and the two main discussions will be "Ophthalmology and psychosomatic medicine," and "The modern treatment of retinal detachment."

Any inquiries should be addressed to the Honorary Secretary, Ian C. Fraser, Esq., 12 St. John's Hill, Shrewsbury, Shropshire.

Reading meetings

The 106th meeting of the Reading Eye, Ear, Nose and Throat Society was held recently at Medical Hall, Reading. This meeting, which was the seventh joint meeting with the Berks County Medical Society, featured a symposium on bacterial allergy. Panel members and their topics were:

Dr. Louis Tuft, chief of the allergy clinic and assistant professor of medicine, Temple University, Philadelphia, "The present status of bacterial allergy"; Dr. Russell C. Grove, chief rhinologist, allergy clinic, Roosevelt Hospital, New York, "Bacterial allergy in otorhinolaryngology"; Dr. John E. Gregory, division of pathology, Hahnemann Medical College, Philadelphia, "The role of allergy in rheumatic fever"; Dr. Archibald R. Judd, superintendent, State Tuberculosis Sanitorium, Hamburg, "Tubercular allergy." Dr. Paul C. Craig, Reading, acted as moderator.

The 107th meeting of the Reading Eye, Ear, Nose and Throat Society was held October 25, 1950, at the Wyomissing Club, Reading, Pennsylvania. A Study Club was conducted on "Ocular therapeutics." Dr. James H. Parker, Jr., Reading,

and Dr. Joseph V. M. Ross, Berwick were instructors.

This being the "Academy" meeting, members who attended the meeting of the American Academy of Ophthalmology and Otolaryngology in Chicago were invited to present their impressions of the highlights of the meeting. The following reported on courses taken at the meeting: Dr. Ernest H. Dengler, Pottstown; Dr. C. Fremont Hall, Phoenixville; Dr. Fred R. Perfect, Wyomissing; Dr. Samuel A. Phillips, Allentown; Dr. Robert E. Shoemaker, Allentown; Dr. Benjamin F. Souders, Reading.

The officers of the society for the year 1950-51 are: President, Dr. Roy Deck, Lancaster; 1st vice-president, Dr. William J. Hertz, Allentown; 2nd vice-president and president-elect, Dr. Harold L. Strause, Reading; treasurer, Dr. Philip R. Wiest, Reading; secretary, Dr. Benjamin F. Souders, Reading; program chairman, Dr. John E. Keller, Reading.

The 108th meeting of the Reading society was held on November 15, 1950. Dr. Harvey E. Thorpe, chief of the Department of Ophthalmology, Montefiore Hospital, Pittsburgh, spoke on "Management of intraocular foreign bodies."

A Study Club was conducted on "Management of early deafness." Instructors were Dr. James E. Landis, Reading; and Dr. C. Fremont Hall, Phoenixville.

Miscellaneous

Research Study Club course

The 20th annual midwinter postgraduate convention in ophthalmology and otolaryngology, sponsored by the Research Study Club of Los Angeles, was held in Los Angeles, January 14th through 26th.

Among the ophthalmologists who served on the teaching staff for the eye instruction courses were: Dr. John A. Bullis, Los Angeles, "Ocular hypotony"; Dr. Irving Puntenney, Chicago, "Problems in refraction"; Dr. Carrol L. Weeks, Los Angeles, "Considerations in retinal detachment surgery"; Dr. Harold F. Whalman, Los Angeles, "Ophthalmic forum"; and Dr. Warren A. Wilson, Los Angeles, "Orthoptics in office practice."

Among the guest lecturers were: Dr. Frederick C. Cordes, San Francisco, who spoke on "Congenital cataracts," and "Surgery of congenital cataracts"; Dr. Irving Puntenney, Chicago, "Recent advances in therapeutics," "Unilateral exophthalmos," "Tumors of the eye and eyelids," "Central scotomas," and "Plastic procedures about the eyes"; Dr. Derrick Vail, Chicago, "The mechanics and dynamics of removal of the lens," "The Smith-Indian operation: Importance of its principles," "The prevention and treatment of immediate postoperative cataract complications," "The hypermature cataract," "Glaucoma in aphakia," "The chiasmal syndrome," "Eyeball shortening operations," and "Ocular complications of joint diseases."

Dr. Archie E. Cruthirds, Phoenix, spoke on "Sulfhydryl therapy in ophthalmology." A special course in "Surgery of the ocular muscles," was given by Dr. Meyer Wiener and associates, Dr. M. W. Nugent, Dr. Richard C. Armstrong, Dr. June P. McBride, Dr. Robert A. Norene, Dr. Robert J. Schillinger, Dr. Edwin S. Wright, and Dr. Walter L. Roberts.

Proctor Foundation fund

The Division of Ophthalmology, University of California School of Medicine, San Francisco, has just received word that the Francis I. Proctor Foundation fund has been increased by $215,000, thus making the value of the fund at the present time in excess of $700,000. The interest from this fund is used to carry on research in the Proctor Laboratories.

Word has also been received from the United States Public Health Service of a grant of $16,000 to be used for research on cortisone and ACTH.

Personals

Dr. S. Rodman Irvine has been appointed associate professor of ophthalmology in the Johns Hopkins University, School of Medicine, on a full-time basis, from October 1, 1950, to June 30, 1951.

Dr. Girolamo Bonaccolto has been appointed clinical professor of ophthalmology at the Post-Graduate Medical School of New York University-Bellevue Medical Center.

Dr. John H. Dunnington of New York gave the annual Mark J. Schoenberg Lecture at the New York Academy of Medicine December 4, 1950, on "Observations on surgical treatment of primary glaucoma." This lectureship was established as a memorial to Dr. Schoenberg's work in the control of glaucoma. It is jointly sponsored by the National Society for the Prevention of Blindness and the New York Society for Clinical Ophthalmology.

Dr. Elbyrne G. Gill of Roanoke, Virginia, has been elected president of the Roanoke Academy of Medicine for the year of 1950-51.

Dr. James W. Smith has been appointed clinical professor of ophthalmology at the Post-Graduate Medical School of the New York University-Bellevue Medical Center.

Dr. Paul Hurwitz has been appointed to the faculty of the Chicago Medical School as assistant professor of ophthalmology.

Dr. William L. Benedict, Rochester, Minnesota, is the 1950 winner of the Leslie Dana Medal, a national award given for outstanding achievement in preventing blindness, according to Dr. Franklin M. Foote, executive director of the National Society for the Prevention of Blindness.

Dr. Benedict, professor of ophthalmology at the Mayo Foundation Graduate School, was selected for recognition by the St. Louis Society for the Blind, which annually awards the medal established in 1925 by Mr. Leslie Dana of St. Louis.

The medal was presented to Dr. Benedict at a dinner in the Hotel Chase, St. Louis, on Friday evening, January 26th. Later in the evening, Dr. Benedict spoke before the St. Louis Ophthalmic Society.

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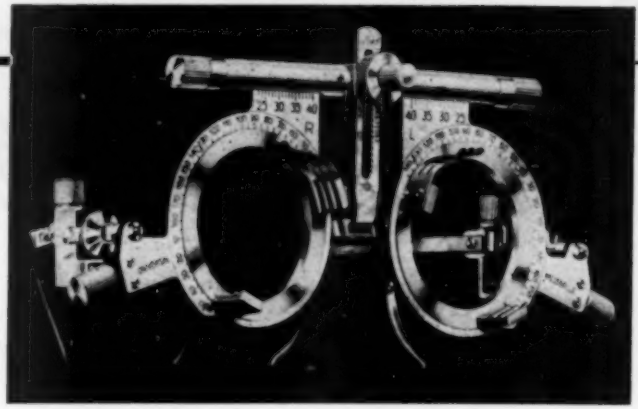

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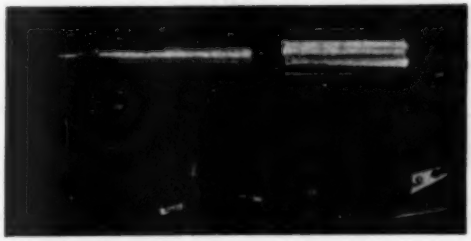

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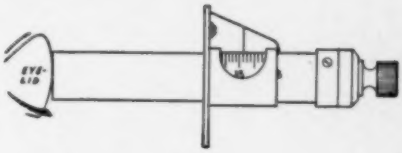

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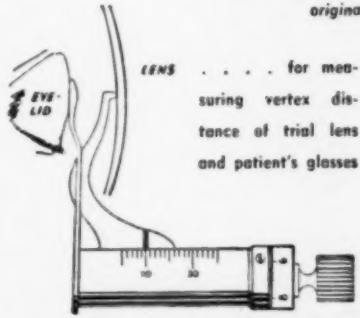

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